Speak↑

"Better lectures, powered by real-time student data"

Team

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Project Summary

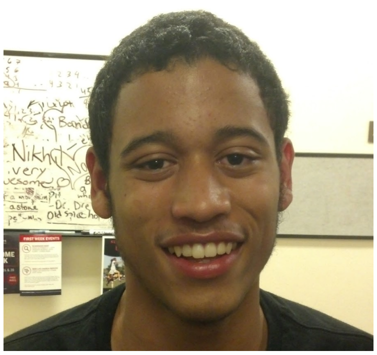
Giving an engaging, interesting, and effective lecture to more than 50 students isn't easy. Lectures occur infrequently, and most instructors don't get actionable feedback when students are confused. This problem can be equally frustrating for students, who become bored when they feel confused by lecture content.

SpeakUp aims to provide real time data about student understanding to lecturers, and offer concrete ways for lecturers to keep students interested. SpeakUp allows students to easily indicate their confusion when watching lectures, respond to "clicker questions" in real time, and helps instructors improve their course content with real time feedback on engagement and clicker questions.

Contextual Inquiry Customers

 *Professor Cynthia Lee*	Cynthia Lee is a lecturer at Stanford University, currently teaching CS106X (Programming Abstractions) and CS109 (Probability and Statistics). Cynthia has been teaching since 2007, and has been involved in education research throughout this time. She has published work on the importance of peer instruction in teaching, and has strong opinions on student participation in traditional lectures. For this Contextual Inquiry, we attended one of Cynthia's CS106X lectures, then watched SCPD video of the lecture with Cynthia. This was used as a substitute for a live interview, which would have been disruptive to students in the course.
Interview Date: Wed Oct 8 (lecture), Fri Oct 9 (interview/video)	Professor Lee was recruited to participate in this project as a favor to one of the group members. We sincerely appreciate her contributions!

 *Irving G.*	Irving is a recent University of California, Berkeley graduate where he studied Electrical Engineering and Computer Science (EECS) and is currently a software engineer at Google. He watches MOOCs on Japanese, as he learned Japanese in high school and wants to practice it on his own. For this Contextual Inquiry, we observed Irving watching a recorded lecture, in his apartment.
Interview Date: Wed Oct 8	Irving is the older sibling of one of our group members.

 *Kyle G.*	Kyle is a freshman that is currently undeclared. He is taking CEE 63 (Weather and Storms) along with 14 more units to make a 17 unit quarter. For this Contextual Inquiry, we used the master-apprentice model while Kyle was at the lecture for CEE 63 to try and understand some common student habits. The class was moderately large, with approximately 60 student in the class.
Interview Date: Mon Oct 6 (lecture)	Kyle is currently a student at Stanford that volunteered to be interviewed by one of the group members.

Contextual Inquiry Results

Of the contextual inquiries we conducted, we chose to present 3 interviews which highlight aspects of the learning experience we're most interested in exploring:

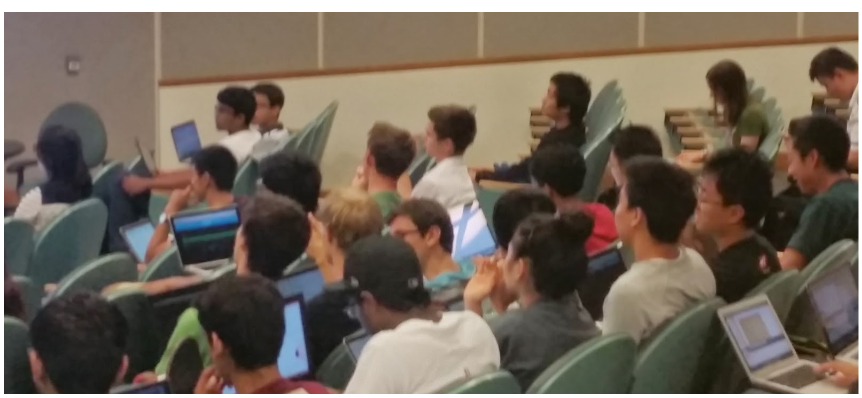
- An experienced lecturer teaching a large course
- A student who watches online lecture videos and MOOCs
- A student in an in-person lecture

Contextual Inquiry #1: Cynthia Lee

In the 50 minute lecture Cynthia delivered for this contextual inquiry, she paused for "clicker questions" a total of 8 times. Cynthia mentioned very specific requirements for the clicker software she used: questions must be repeatable and the must control when results are displayed or not displayed to students.

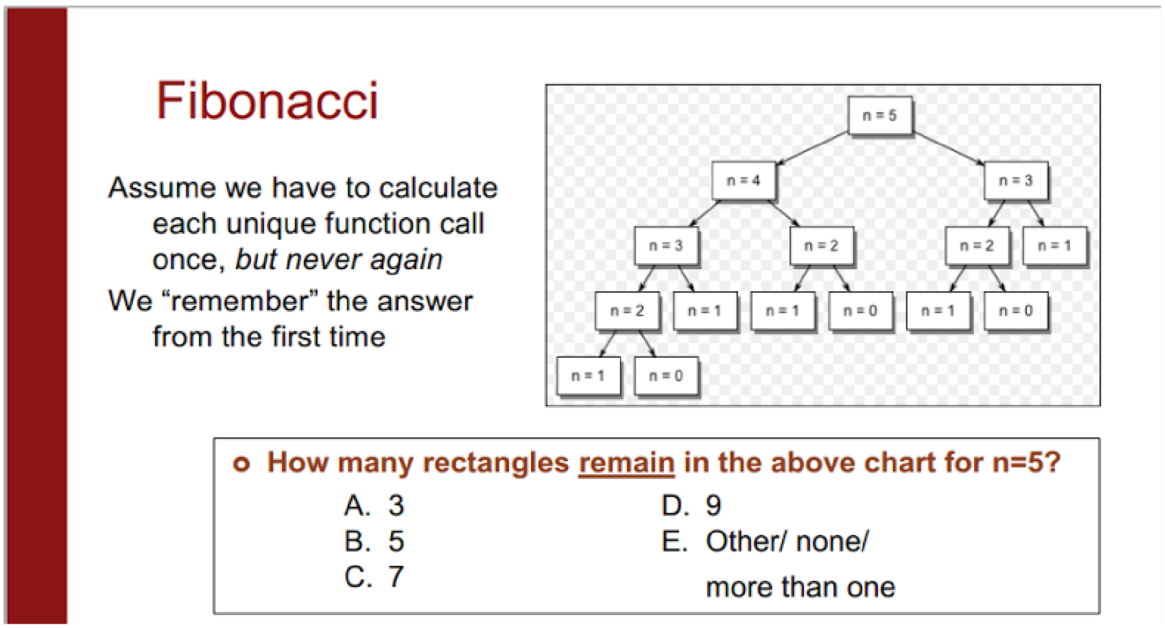
Cynthia Lee giving a CS106X lecture. 81 students are enrolled in CS106X, and most students choose to attend lecture. This was the lecture used in the contextual inquiry interview.

Cynthia cared very deeply about the process of students answering clicker questions, and learned a lot about how well students understood the material by looking at their responses. When an unexpectedly large number of students answered a question incorrectly, Cynthia could use that question to start a discussion about the larger concept.



CS106X lecture uses a clicker-question system for instruction. Every 5-10 minutes, Cynthia will pose a question to her class. Students first think about the question by themselves, then discuss it in groups and select an answer using a "clicker" device. Finally, once everyone has answered, Cynthia takes suggestions from the class.

Cynthia provided valuable feedback on keeping students engaged with clicker questions as well. Clicker questions which were too hard could lead to students becoming frustrated with the lecture, while simple questions left students bored. Cynthia tried to make sure that between 30 and 75 percent of students got a question right when it was first asked.

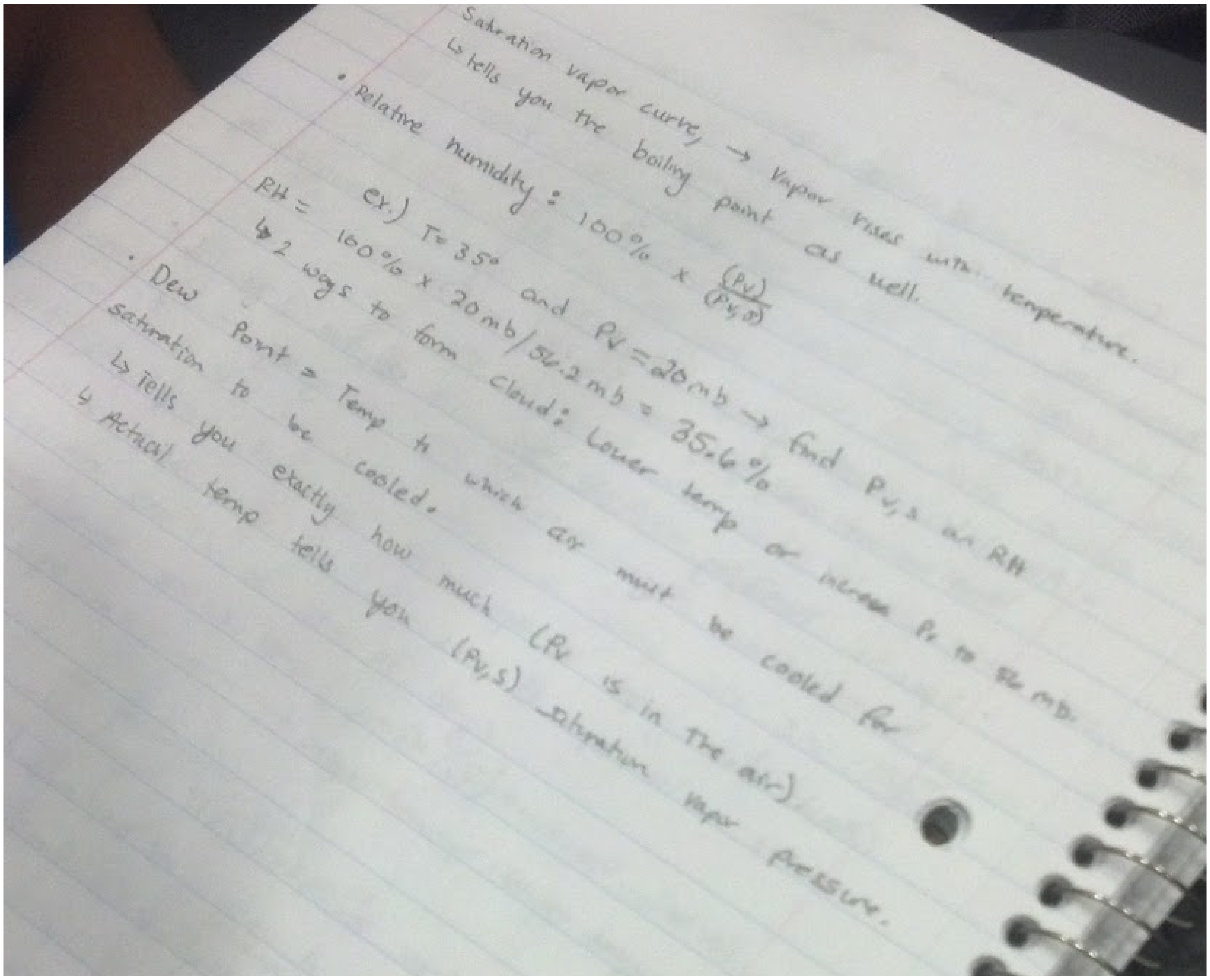


An example question posed to the class during Cynthia's lecture.

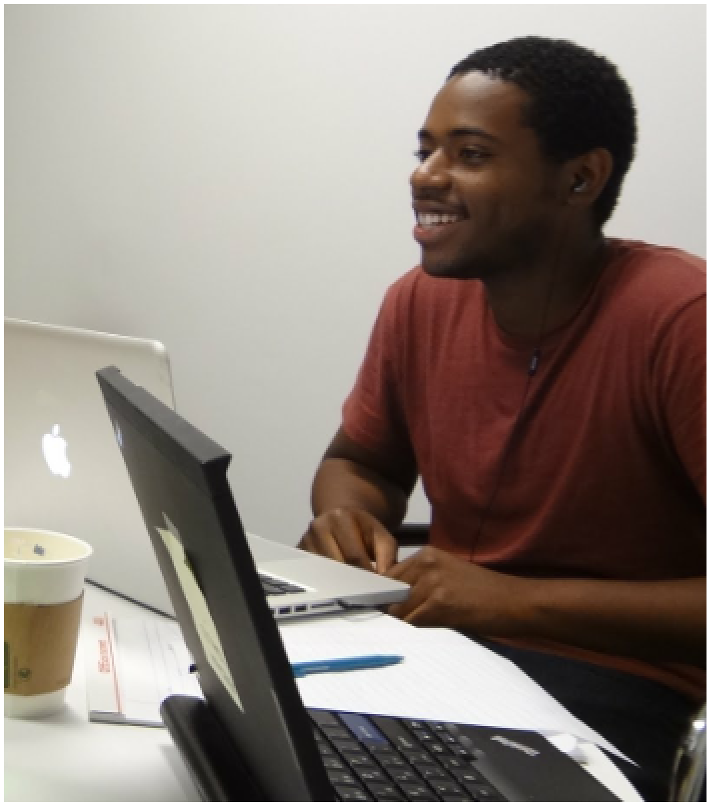
Contextual Inquiry #2: Irving G.

In order to have a range of student perspectives from which to approach the problem, we wanted to interview someone who used online learning tools. This contextual interview took place in Irving's apartment while he was watching an online learning video. We observed his learning style and how he obtained clarification when confused about topics presented during the video. Because the lecture was pre-recorded, Irving did not have a good way of providing feedback to the instructor.

At various points in the lecture, Irving had trouble understanding certain words due to the instructors articulation. Unfortunately, he did not have a good method of conveying this confusion to the instructor. This was a constant theme through the instructor's lectures, and although the instructor may have easily corrected this behavior if he had known viewers were struggling to understand some of the words he said, the viewers had no good way of giving the instructor feedback while watching the recorded lecture videos.



A sample of the notes Irving took while watching an online lecture.



Irving watches a lecture and takes notes.

Contextual Inquiry #3: Kyle G.

By using the master-apprentice model with Kyle, we were able to see how distracted students can be during classes, even ones that are still engaged with the lecture. Even at the beginning of lecture, Kyle had more than ten tabs open on his computer, saying he had them all there because each of the tabs represented something important that needed to be done. Afterwards, he used his computer to pull up the Powerpoint for the current lecture so he could follow along with the lecturer's notes and he pulled out his own notebook to take hand-written notes, citing the fact that he enjoyed having control over the pace of the slides at the same time he was doing notes. Even during this busy multitasking, whenever Kyle was confused about something, he was not hesitant to raise his hand or ask a question, saying he felt comfortable doing that, even in a larger class setting. The handwritten notes were all incredibly neat, sorted by the dates of the lecture.

The view of the CEE63 classroom from Kyle's perspective.

We ultimately learned that even the most engaged students have distractions during lecture, somthing we will definitely take into account when devising a solution to the problem at hand. Likewise, Kyle's setup for note taking, a computer with lecture notes and his own hand-written notes, was helpful since it told us that Kyle learns best when he controls the pace of the class, something most students (especially without access to the Powerpoint themselves) do not have control over.

Task Analysis

1. Who is going to use the system?

The lecture feedback system is designed to be used by a wide range of students and professors. The system is intended to be used where there is a high student to teacher ratio. This occurs both in the case of large lectures and in various types of online classes. Our product is specifically focused on students who avoid speaking up in class and talking face-to-face with the professor.

2. What tasks do they now perform?

Currently, most students are unengaged during lecture or rely on taking notes to keep them focused. A small minority of students ask and answer questions during lecture while most attempt to learn passively.

Professors have varying teaching styles, but most ask the audience questions to foster engagement. Lecturers also attempt to measure material retention and understanding by paying attention to the audience, but this is incredibly difficult. Some lectures even dare to ask students if their previous explanation of the material was clear; to which students reply with blank stares. This approach only works with the minority of students willing to speak up during class.

3. What tasks are desired?

We want to create a simple yet delightful user experience for three primary tasks:

1. **Allow students to indicate confusion and provide feedback in lecture**. When lecturers make mistakes or phrase an explanation poorly it's extremely helpful for them to get quick feedback that students aren't able to follow along.
2. **Enable lecturers to instantly pose questions to the whole class**. Instructors often pose questions to their students during lecture. More modern professors often use "clickers" and other interactive technology to interrogate the whole class simultaneously.
3. **Help lecturers improve their content and presentation** by giving them feedback based on real time data about student engagement and understanding of the content being presented.

These tasks span a wide range of difficulty, from simple (indicating confusion) to nuanced (posing questions to a class), to downright difficult (improving lecture content and presentation). We selected tasks one and three since they most closely supported our project goal of improving communication between students and lecturers. Task two was included as a result of our CI with Cynthia Lee, which suggested that instant-response questions could provide a great way to make the feedback we provided to lecturers more concrete.

4. How are the tasks learned?

Currently, these tasks are learned by lecturers iteratively and through experience, if at all. Most professors use course reviews and suggestions from a small number of students to refine their lectures over the years. Improvements can take years but are occasionally jump started by input from other professors and select students. Some lecturers are naturally good at teaching and engaging the class using a variety of techniques they picked up as students.

Most students do not give feedback on lectures and professors unless they feel insulted or wronged. However, some students do actively provide useful feedback. Teachers who plead their students for reviews are more likely to receive neutral reviews with small points for improvement. Over time, students also develop their own style of engaging and indicating interest in lecture. Most students are motivated by grades and results, so a student's attentiveness in lecture is often the style that has been shown to provide good grades while still being natural and comfortable.

5. Where are the tasks performed?

Questioning and feedback both occur when students are viewing lecture content. While students observe a lecture, they may ask questions to the lecturer, answer questions from the lecturer, or provide feedback on the lecture (either implicitly or explicitly).
Tasks are typically performed during lecture.

6. What's the relationship between customer & data?

For the students, the data is personal information about his/her performance, learning, and habits as well as perspectives on the lecture and professor. The personal nature of academic information and sometimes unpleasing points of view make privacy and anonymity definite concerns for our project. For lecturers, the data is an opportunity for constructive criticism that will hopefully make lectures even better in the future. In addition, lecturers, though not the owners, are directly tied to the data.

7. What other tools does the customer have?

For students and professors, the primary tool is the clicker, with its relevance hinging on the professors teaching style. Outside of the clicker, there are no strict tools that students use, as raising your hand and asking a question is the primary method to overcome confusion. With the extreme simplicity of clickers and lack of other tools, our project tackles an area with substantial room for innovation and improvement.

8. How do users communicate with each other?

Most of our intended customer base do not communicate. To be more specific, most students refrain from providing feedback or asking questions regarding lectures. Communication that does occur is usually verbal and at the end of lectures. This point emphasizes the gap in communication between professors and students that we are trying to bridge. Allowing students to provide honest, and immediate feedback to the lecturers will provide an accurate report of the students' understanding level.

9. How often are the tasks performed?

These tasks do not currently follow a fixed structure. Most lecturers and courses receive feedback at the end of quarters. Other feedback on student attentiveness and learning is provided in an extremely sporadic manner, most often at the discretion of the students. Students rarely receive any feedback on their own learning styles.

10. What are the time constraints on the tasks?

All tasks are roughly contained within lecture. However, these tasks compete with material and other learning activities during lecture. Therefore, the timestamp of our tasks must be fairly minimal. Lecturers are not likely to be interested in a tool that requires them to change lecture content.

11. What happens when things go wrong?

Student learning is highly dependent on lecture quality. If professors do not do a good job of communicating with their students, students will struggle to learn, get bad grades, and sit through mundane lectures. However, consequences are usually not severe. Students learn and retain less, but bad professors are accepted as a part of the current education system. Changing this reality would likely require changing the expectations of the people involved.

Using technology during lecture can also go wrong. Technology is extremely powerful, but also very distracting. Encouraging the use of a "mobile" tool could cause students to loose focus and begin watching each other instead of focusing on lecture.

Best Application Ideas

Project 1: Lecture Feedback with Data Collection

Our first idea is an application that communicates immediate and long term feedback to both the students and professors during either live or online lectures. To do this, the application provides students with an easy way to ask questions, indicate any sort of confusion during a lecture, answer questions, and ultimately improve lectures for both parties.

Project 2: Real-Time Questions: Augmented Reality App

This idea works to help the lecturer visually see when students have questions. Students have the ability to ask questions with a device, and other students can, in a sense, upvote a certain question. The lecturer physically sees the questions above the student's heads so he/she knows what questions need to be answered while giving shy students a chance to provide input in the lecture.

Project 3: Attentiveness with Incentive Scanner

This application would scan the room and see whether students are being attentive or not. Attentive students would get positive points, and non-attentive students would get negative points. Points will lead to extra credit or other types of rewards. In this way, students engagement is incentivized, while also collecting data for the lecturer by revealing student habits and trends.

Significance / Feasibility

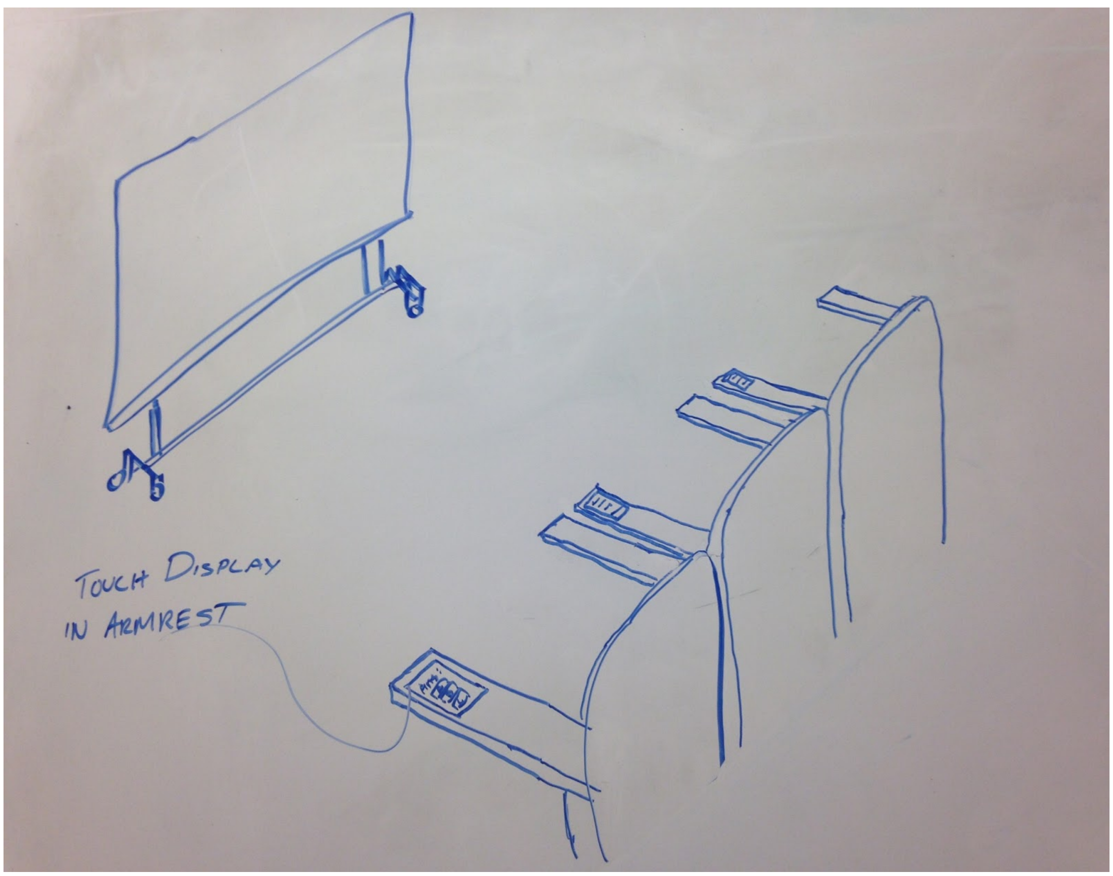
Project	Significance	Feasibility	Interest
Lecture Feedback and Data Collection	3/4	4/4	4/4
Real-Time Questions: Augmented Reality	3/4	1/4	2/4

Attentiveness with Incentive Scanner	2/4	1/4	2/4

Final Selection: Lecture Feedback and Data Collection

Project one addresses directly addresses a particular concern: lecturers get no feedback on their work. The project is significant, could be feasibly implemented by a small team, and appealed to all of the members of our group. We believed that project one was the best way to address the concerns of both students and lecturers which arose during contextual inquiries. While the other projects considered seemed appealing, it wouldn't have been as straightforward to build a high-quality prototype.

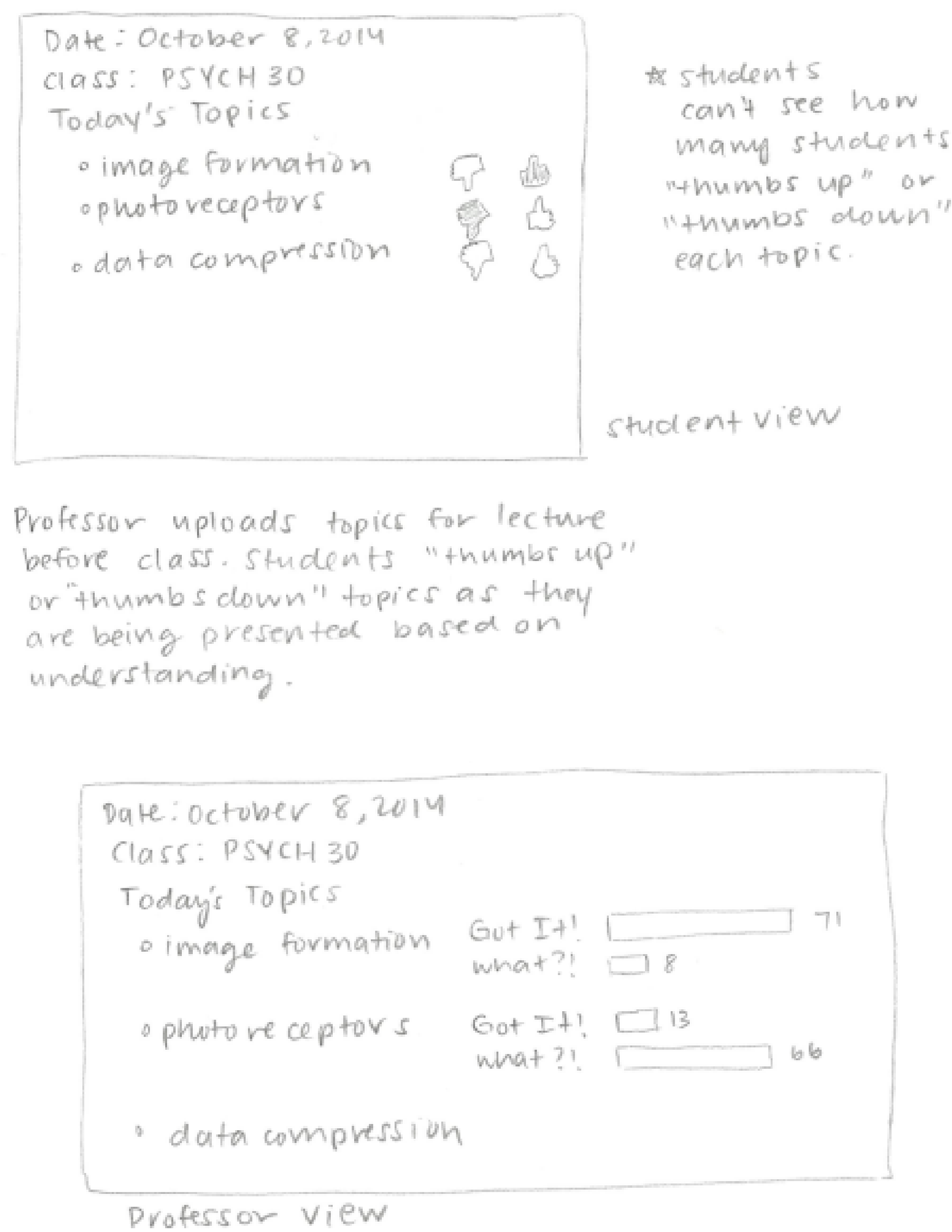
Sketches



Artist: Nick Akiona

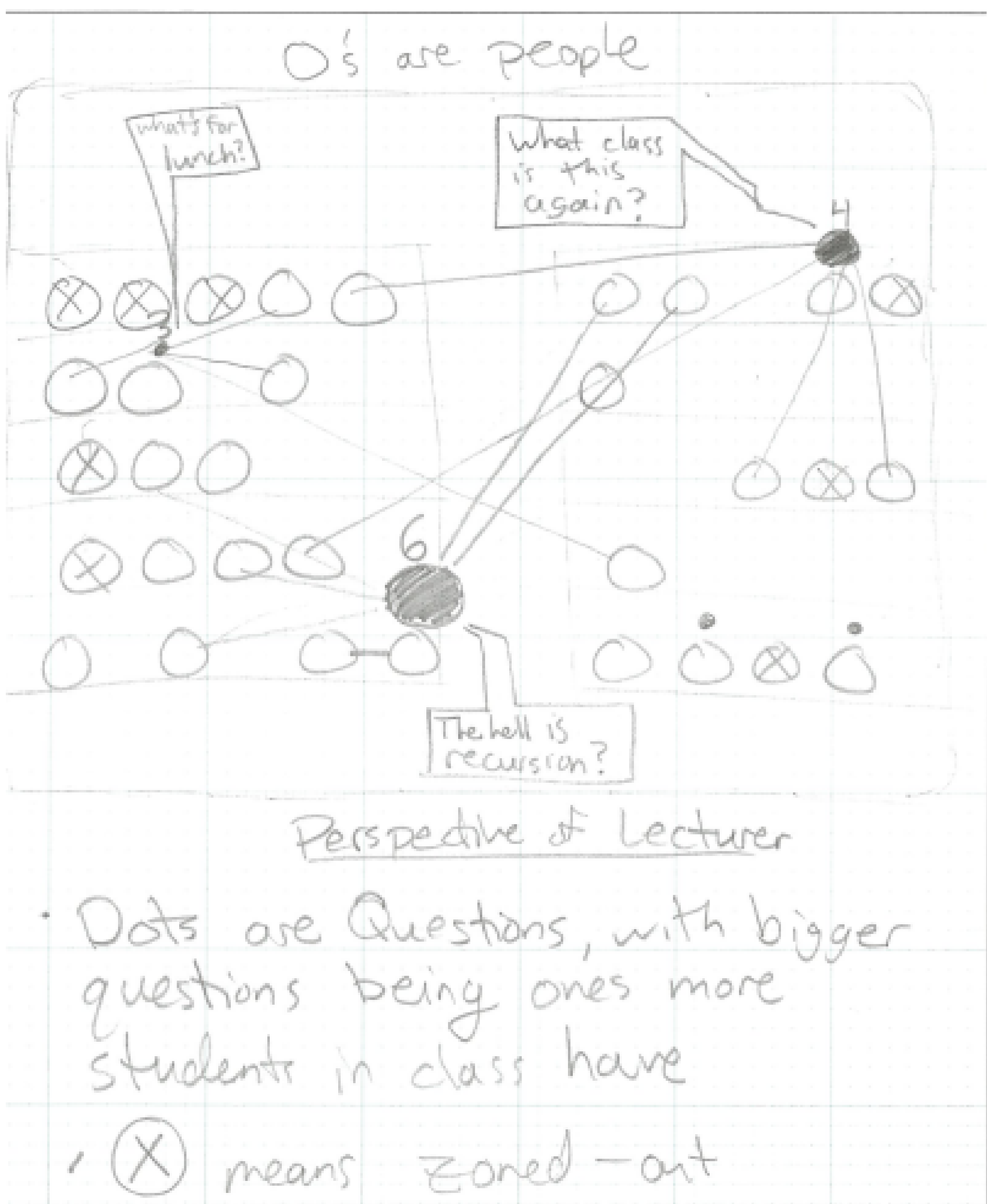
Nick was concerned by the possibility of students being distracted by apps on their phone when they used our product. This sketch represents an interface which sidesteps the problem of distractions by embedding the feedback system in the armrest of the chairs in a

lecture hall.



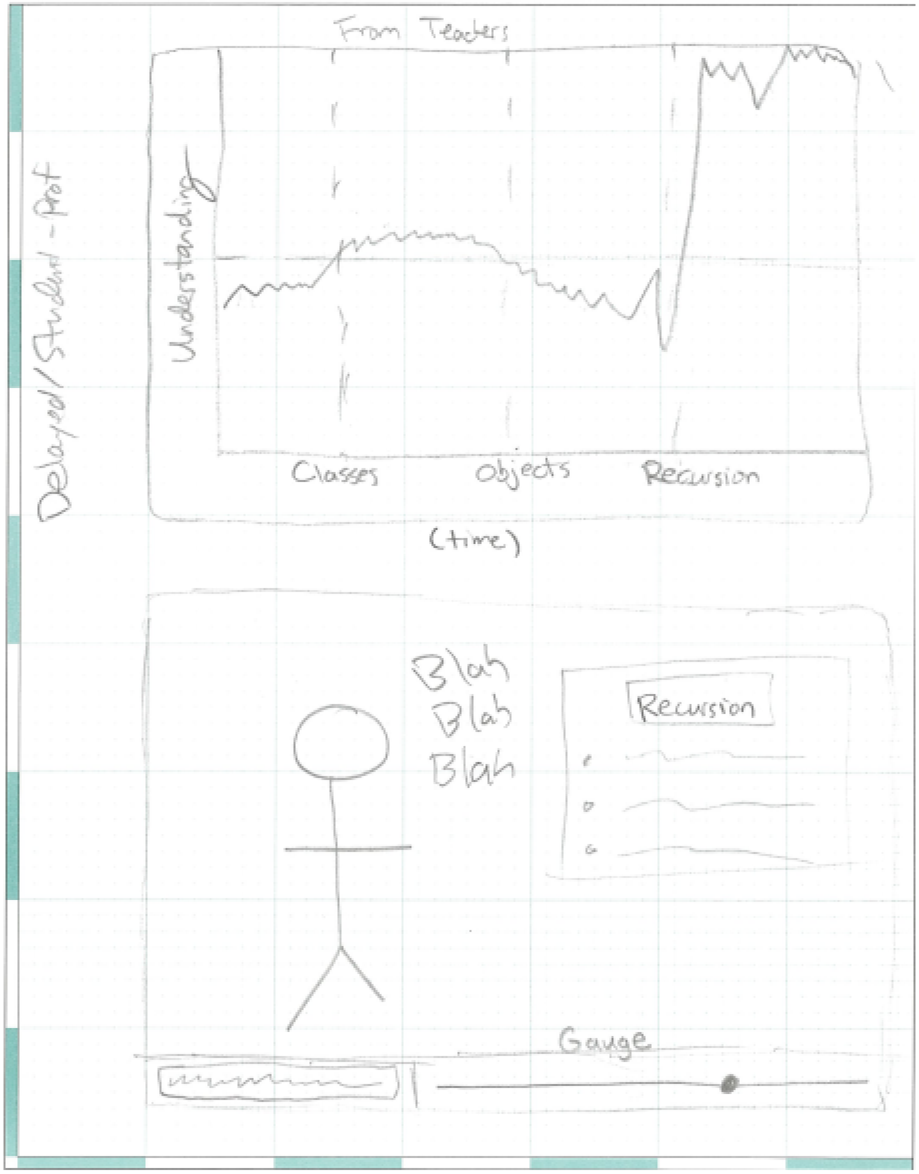
Artist: Karen Gomez

Karen's sketch demonstrate a topic-focused interface to our product. Students don't manipulate sliders or gauges, and instead focus on specific lecture-specific topics.



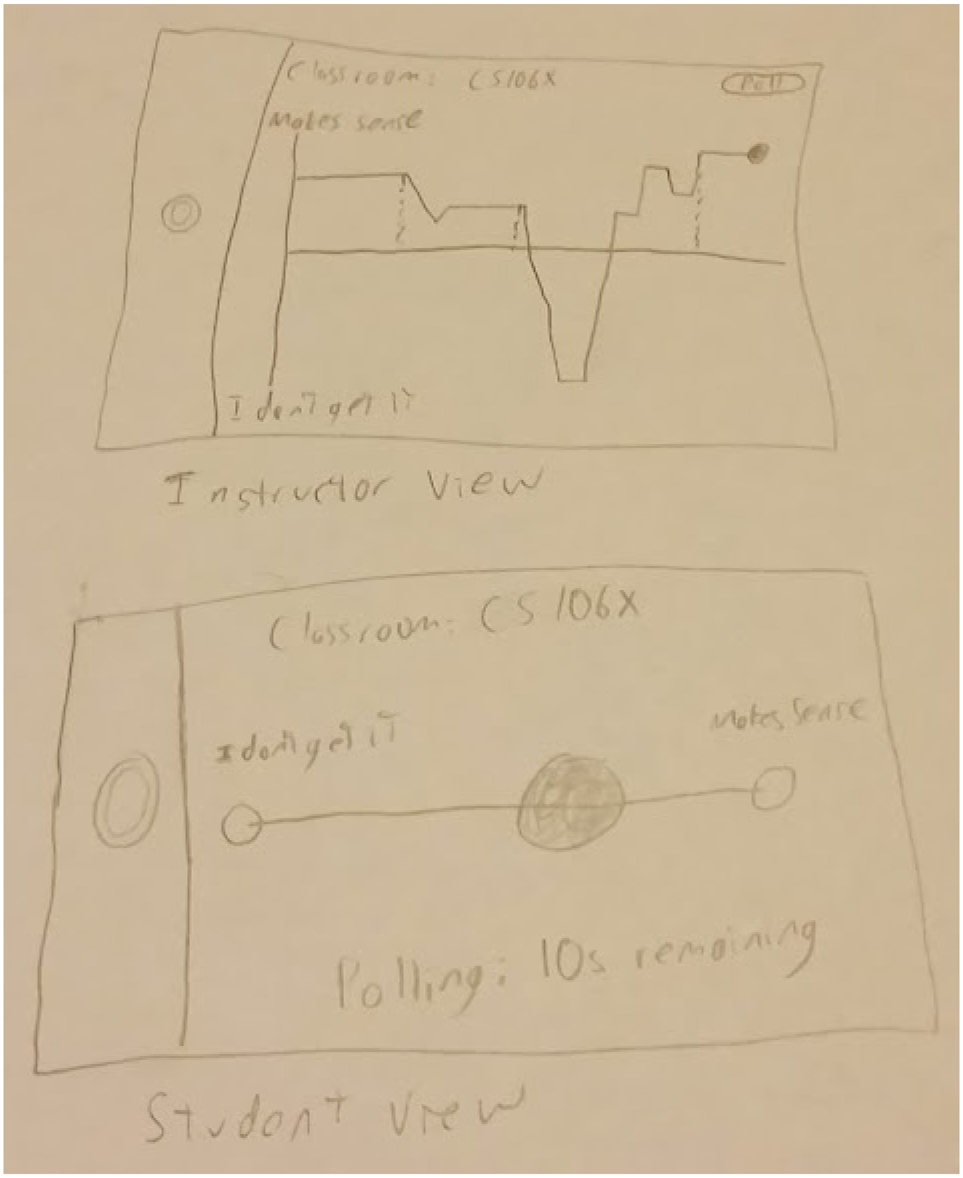
Artist: Brad Reyes

Brad came up with a really creative interface for helping students indicate confusion and enabling lecturers to respond to such confusion. We liked this sketch so much that we adapted it into a separate project idea entirely (see application idea 2).



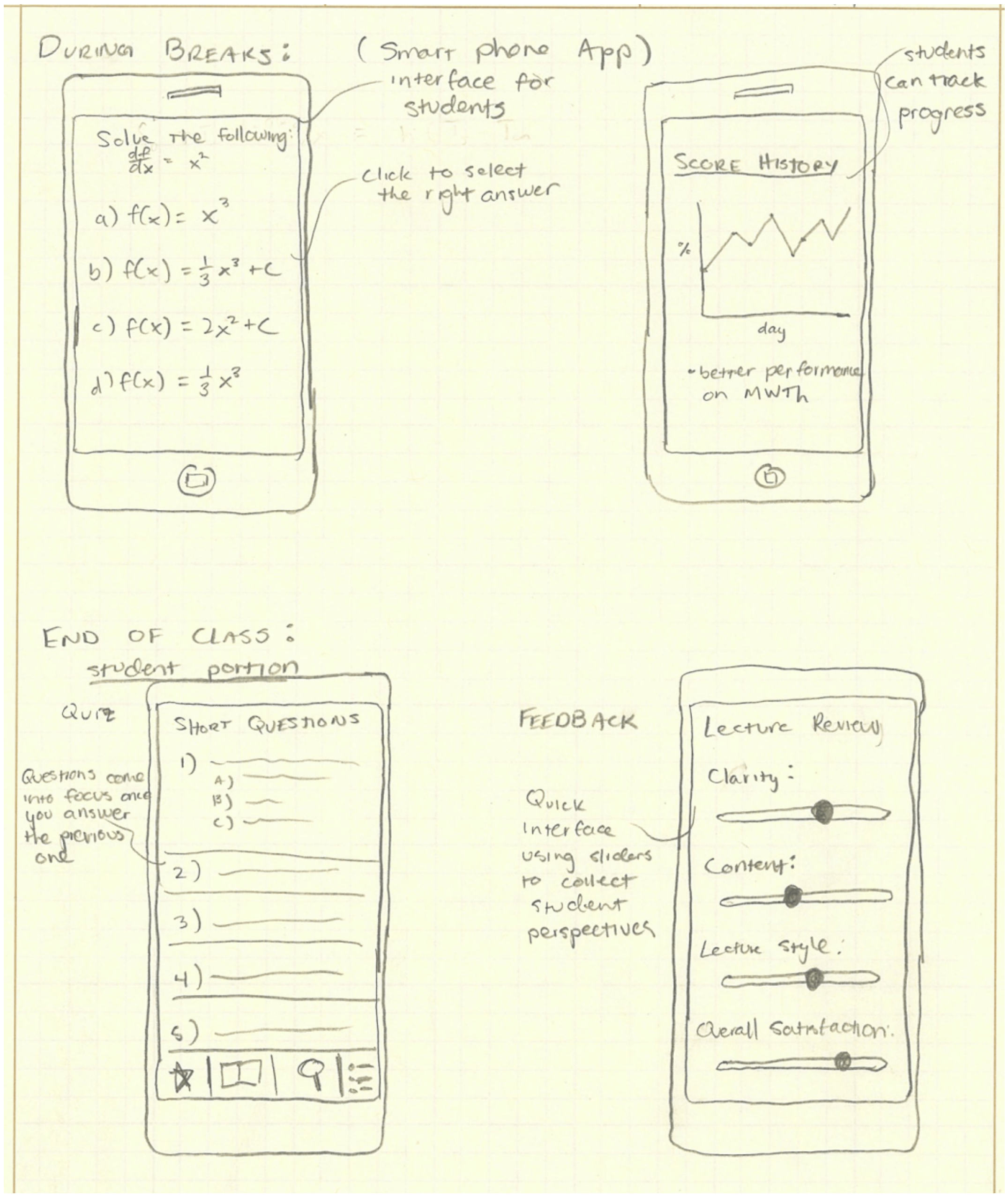
Artist: Brad Reyes

One of the interesting aspects of the application idea that we chose is that many of the tasks could apply to MOOCs. Many MOOCs pause lecture videos for in-video quizzes, similar to how instructors may ask clicker questions in live lectures. Brad drew a clever sketch demonstrating what a possible interface for our product would look like in a MOOC.



Artist: Reid Watson

Reid's sketches were very rough and focused on the primary functionality of our application. One interesting aspect of the sketch pictured above is the idea of "polling": allowing an instructor to explicitly request feedback from students on a completed section. This idea was not included in our final project idea.



Artist: Nick Akiona

This set of sketches from Nick focused on combining in-class feedback with an elegant interface for the end of a class. Students had a simple way to review their understanding of the material presented in lecture, and a convenient way to provide feedback on the content presented.