Clarity

I. Value Proposition:
Clarity closes the feedback loop between students and teachers by lowering the energy barrier for student input while increasing the quality/value of student feedback.

II. Roles:

Ari Echt-Wilson:	User Testing/Design
Sherman Leung :	Development
David Eng:	Development
Akaash Nanda:	Product Manager, BD

III. Problem Statement and Solution Overview:

Teachers of a large class have no easy way of soliciting feedback while they lecture/teach from their students. Part of the reason why a teacher's lecturing style seldom improves is because all the feedback they receive is delayed and somewhat "after-the-fact." Like with anything else that requires trial & error to improve, teaching, too, should be rapidly iterative. Some students are afraid to ask questions while others are too overwhelmed by their confusion to even considering interrupting the professor. A live mobile/web-based interface allowing students to anonymously indicate when material presented by the teacher is unclear can alleviate confusion and encourage teachers to spend more time/effort on unclear material on the fly. Equipped with this information, a teacher can make an informed decision to backtrack to a specific topic, ask for questions, and ensure as few students remain confused as possible.

IV. Contextual Inquiry Customers:

<u>Percy Liang (Instructor)</u>

Percy is an assistant professor in the CS department who teaches CS 221 (Intro to Artificial intelligence). Percy exemplifies the instructor profiles that we will be catering to - an interactive teacher quick to adopt and even build technologies to interact with his students. Percy was recruited personally via email by Sherman, a student currently in CS 221 who approached Percy during his office hours. Percy's strength as a lecturer lies in his ability to communicate effectively with his students through live coding sessions and an interactive features of his slides.

<u>Aditya Srivatsan (Non-technical student)</u>

Aditya fits the category of non-tech students perfectly in how he behaves in class. He is currently a junior studying biomechanical engineering with a course load focused largely on hard-science subjects. He is well versed in biology, chemistry, and a variety of life sciences currently focusing on enriching his knowledge of more complex sciences in preparation for the MCAT examinations. Aditya was brought into the process by Akaash (as he was a personal friend of Akaash) to give the team perspective on how students who take manual notes in class behave during lectures. Being the diligent student that he is, Aditya augmented our understanding of how non-tech students tend to interact with materials, professors, and class notes.

Nick Bagamian (Technical Student)

Nick is a sophomore studying Computer Science. Nick is primarily taking computer science and math related courses who has worked a lot with technology in lecture. He is a student who is still figuring out how to learn best in a lecture environment. We got his feedback on the problems and difficulties with working with computers in class and how to best interact when he gets confused. Ari recruited Nick for an interview because he was going to be watching lecture videos and going over slides for a class he had previously missed. This was an opportunity to watch how a student learns in lecture itself even though we would not be able to conduct an interview during an actual lecture.

V. Contextual Inquiry Results:

Sherman <-> Percy Liang (Figure 5.1)

This interview focused on an instructor's perspective of the teacher-student interaction. Given Percy's background as an interactive lecture, we were interested in his motivations behind his use of interactive questions in lecture. He provided some valuable insights into the effectiveness of this tactic namely:

- It gets rid of the group mentality against raising hands
- It's anonymized and forces students to stop and think rather than nodding and drifting along
- Allows Percy to hone in on what the class finds confusing about a subject

Given the tasks and the parts of the application that were sketched out before the interview, Percy gave his opinion on the effectiveness of each feature and important points to consider:

- In Figure 5.2, Percy commented on the importance of providing simple easy ways to interact with the lecture He honed in on the importance of a quick interface that lowers the energy barrier for interaction.
- When asked for his opinion on combining the slide interactivity (Figure 5.2) with the ability to direct questions towards a particular area on the slide, Percy noted that the activation energy to pose a question on the slides may prove too high to effectively receive a quick gauge on student understanding.

Percy emphasized the importance of designing a user experience that is fluid and provides little friction for student interaction. The incentive for people to interact with the lecture needs to be more than pure frustration. A network effect perhaps similar to what Piazza uses needs to be present to incentivize and synergistically improve course content and understanding by interaction with our application.

Akaash <-> Aditya Srivatsan (Figure 5.3)

Having a candid conversation with Aditya about his experience in large classes provided us with a much deeper understanding of what student-professor disconnect looks like across a variety of subjects. Aditya mentioned that most of the material covered in his chemistry class, for example, is complicated in nature and is difficult to take notes on via a laptop or other digital medium. Diagrams are necessary and the act of notetaking in a class like this serves a very different purpose: Aditya mentioned how in most higher level lectures for science courses, the sole purpose of class is to blindly copy notes from the slides/lecture in order to understand them on your own at a later time.

Figures 5.3 & 5.4 give us a sense of what Aditya's notes during lecture look like. When asked about how he handles being confused in class, Aditya mentioned that he tended to make sidenotes of questions he had while taking notes so that he could follow up with TAs later. This raised the following questions:

- What prevented Aditya from asking questions during the lecture itself to enhance his understanding of material in real-time?
- What purpose did his notes serve to him if they were nearly identical to the slides the professor was using?

Upon being asked both questions above, Aditya mentioned *intimidation* as being his greatest barrier to asking a question in class. He then followed with talking about his favorite lecture (a Physics lecture) where he appreciated the fact that the professor would distribute lecture notes to all of the students prior to class. The understanding was that students would then spend all of class *making sense of* the notes instead of blindly copying them.

We then asked Aditya to complete the basic task of watching a video lecture (something atypical of a non-tech student like him) and taking notes (shown in Figure 5.2). What we observed was a tendency to pause the video, catch up on taking detailed notes, and then re engaging with the video. His interview provided us with some interesting insights to consider in honing in on how our solution will behave.

Ari <-> Nick Bagamian (Figure 5.4)

We spoke with Nick to get a better idea of technology's role in the classroom currently. Nick takes a lot of computer science and math classes and uses his laptop in order to take notes. We wanted to find out:

- What role does the computer currently play in the classroom?
- What are the important things to keep in mind when developing a technological feature to accompany a lecture?

We found that the use of technology becomes very distracting in class. When Nick uses his computer to take notes he can easily switch to email, Facebook, or other sites when he is not engaged by the lecture. Therefore, we realized it would be beneficial to encourage more interaction on the computer during lecture. Instead of the computer serving as simply another platform to take notes, it could a virtual classroom integrated with the live lecture itself.

We watched Nick as he reviewed lecture slides from a previous lecture as he did his homework. Nick used the lecture slides because there were similar problems on the homework. He compared the lecture slides with his own notes and tried to work through the problem. One comment he made was, "sometimes slides don't tell the whole story." Although he could reference the slides, they are not a replacement for the what the instructor adds to them.

We also spoke with Nick about what he does when he is confused. He mentioned two things:

- Turning to friends around him to ask for clarification on a question
- Waiting and going to office hours later because he does not like to interrupt the flow of lecture to ask a question.

These are important for how we develop an application. We want to improve on the existing ways of checking for understanding (such as clicker questions and asking students for questions) so that it does not disrupt the flow of lecture and the professor can just focus on providing material. In addition, there could be a social aspect to helping students who are confused in class. This does two things: it lifts some of the burden off the professors and TAs and it also gives students who do understand a chance to teach, which can improve comprehension as well.

Task Analysis Questions and Answers:

1. Who is going to use the system?
   Students will use this system to provide feedback to their instructors during course lectures. By reducing the friction associated with reporting material of concern and requesting clarification of the instructor, our system will aggregate student feedback to provide suggestions to the instructor. The instructor will then peruse the provided feedback and adjust lecture material accordingly.

2. What tasks do they now perform?
   Characterized by passive consumption of lecture material, tasks of students in the current system include transcribing verbal content provided by the instructor into notes on either a device (e.g. iPad, laptop, etc.) or paper. Meanwhile, tasks of instructors in the current system include executing a usually rehearsed (sometimes not) lecture narrative, seldom influenced by student sentiment.
3. What tasks are desired?
   We want to reduce the activation energy for students to report material of concern and request clarification from the instructor. By providing a simple user interface with which students may interact to provide feedback to the instructor, we seek to engage students in a task relevant to their academic well-being. This task involves feedback to both binary inquiries ("Did you understand the topic?") as well as contextual inquiries ("Express the logistic regression function in the form of the exponential family.") set by the instructor. More importantly, this task must be simple to complete—anything more would be distracting and actually detract from the academic setting. Regarding the desired tasks of the instructor, we intend for the instructor to peruse the collected data to improve his or her lecture narrative.
4. How are the tasks learned?
   Students and instructors individually will learn the tasks required for our system. An intuitive interface will lower the learning threshold for these tasks. Including a tutorial when each individual first opens the application would also help in this learning process.
5. Where are the tasks performed?
   Students will perform these tasks during the lecture, while lecturers may opt to spontaneously pivot presented lecture material during the lecture or review the collected feedback from students in their offices.
6. What's the relationship between customer and data?
   Students will not interpret the data directly; rather, they will create the data. Instructors will interact with the data more intimately and answer questions such as "How many students comprehended the part of the lecture?" or "What could have been explained better?"
7. What other tools does the customer have?
   A similar system involves the iClicker. For example, the introductory physics courses often require student response to content-based questions via iClicker. These systems are designed to engage students two to three times per lecture and, depending on student accuracy on each question, empower the instructor with a tool to gauge topics of difficulty for students.

8. How do users communicate with each other?
   We intend to include a web interface and a mobile interface for users to communicate with each other. The mobile interface will provide students with a means to submit feedback while the web interface will provide instructors with a means to review student feedback.
9. How often are the tasks performed?
   Depending on the nature of the course, the task of consuming lecture material will be performed by students in 50 minute increments, at least once per week. Students will lose attention on average three times per increment, which follows from the fact that an individual's attention span averages from 15 to 18 minutes. Thus, it makes sense to perform tasks associated with our system at least three times per lecture.
10. What are the time constraints on the tasks?
    While the instructor may benefit from a higher volume of precise student feedback, we recognize that the tasks associated with our system should be minimized—no task should require more than five seconds. This time constraint follows from the need to collect meaningful data to improve the course setting without also distracting the student.
11. What happens when things go wrong?
    When students must wrestle with our interface rather than reinforcing lecture material, things have gone wrong. To avoid this outcome, we intend to rapidly iterate on versions of this interface since the composition of brevity and meaningful student information will form the backbone of this application.

Old and New Tasks (describe and rationale)

1. <u>Student indication of confusion</u>: This task is traditionally a very *simple* one--essentially the equivalent of raising one's hand in class and saying "I'm confused." However, by digitizing this task, we hope to overcome the reservation students may have to speak up in class and express their confusion. We believe this is a necessary task to investigate because it is the most fundamental interaction between students and teachers and the most basic form of feedback the teacher receives from a student. A binary indication, either an indication of *understanding* or *confusion*, is enough to slow the pace of the class and create a more effective classroom dynamic.

2. <u>Professor knowing class understanding:</u> This task is a *complex* task because it demands that a professor be cognizant of how students in his/her class perceive the information they present. In other words, this task involves the professor recognizing when students in their class are confused in order to slow

down the pace of the lecture and recap material covered earlier. Our rationale behind experimenting with this task stems from the very inspiration for our product. Our team is looking to equip students with a streamlined way to communicating with professors without interrupting class while also outfitting professors with the tools they need to pinpoint when their class begins to struggle with understanding and what it is that the class is confused about. This task is the crux of the problem we are trying to solve.

3. <u>Questions about material:</u> Although many professors allow time for questions in class, many students are uncomfortable with raising their hands and asking questions in such a large lecture. As a result, many students leave lecture feeling confused, and they spend time outside of lecture trying to catch up. By incorporating technology, students can ask questions anonymously and realize that other students may have the same questions about the material. Questions during lecture are an extremely important part of solidifying understanding. This is a moderate task because it requires more thought and action from both the students and professors.

4. <u>Passive notetaking vs. collaborative interaction with live class material:</u> Lectures are an extremely passive form of learning. Currently, students attend lecture and take notes on course material from slides. Professors are unaware of what material may be confusing or need more elaboration. There is also very little difference now between a professor speaking to a classroom full of students and him/herself. Therefore, a new task is students' ability to interact with class material directly while lecture is taking place. This is a more complex task because it requires a greater change in current lecturing practices. There is more student initiative in order to make the classroom more interactive between students and professors even in large lectures.

Three Best Application Ideas

Mobile interface to input understanding with live analytics: (Figure 5.5)

We envision a mobile understanding app that is extremely simple in design and use. Its primary task is to allow students to give live feedback to the professor on their understanding of the material. Students would be able to assess their own understanding and professors can adjust their lecture to spend more or less time on specific subjects according to the live analytics they receive on their computers. We currently picture a dial for students to rate whether they understand the material, are becoming confused, are confused, or things are making more sense. In addition, there could be a question box for students who have a specific question that can be submitted live to the professor. The question box allows students to submit questions without interrupting the flow of lecture and having to raise their hand in class. In addition, professors can be selective in which questions they answer.

Mobile/yikyak version:

We believe there is an important distinction between students who are confused during a lecture and those that are following along. It would be conducive for both groups of students to . Therefore, we have a second mobile app idea that allows students who are following to swipe right and continue with the lecture. However, if a student is confused, they can swipe left to view questions others have and input their own questions as well. This "yikyak" inspired application is centered around students being able to ask questions anonymously. In addition, students would upvote and downvote questions, giving them priority, and professors can see what the most pressing questions are. By crowdsourcing question ratings, students themselves are controlling the quality of questions asked.

"Live" slide + analytics:

We also wanted to have an application that presents more directed information for the professors and help students with more specific content related questions. Our current idea is a form of integrating interactivity into the lecture environment for a more engaging learning environment. Professors can release their slides to the class before lecture so students can view them real time with the professor. Instead of, or in addition to, taking notes in a separate document, students could simply add to the slide material. For the interactive portion, students would be able to highlight areas of the slides that they are not understanding. They could pose a specific question about the material or simple show that they are not comprehending. The professor would see a "heat map" style of the slides on their desktop. The slides would be color coded with the severity of misunderstanding. Finally, students could revisit these slides later and get a more complete view of what was presented in lecture.

Application	**Significance**	**Feasibility**	**Interest**
Mobile interface to input understanding with live analytics	-Low energy to participate - Live interactivity Post-analytics for professors	-So long students can utilize phones in class, should be feasible.	Yes
Mobile/yikyak	-Most content	-Requires student	Yes

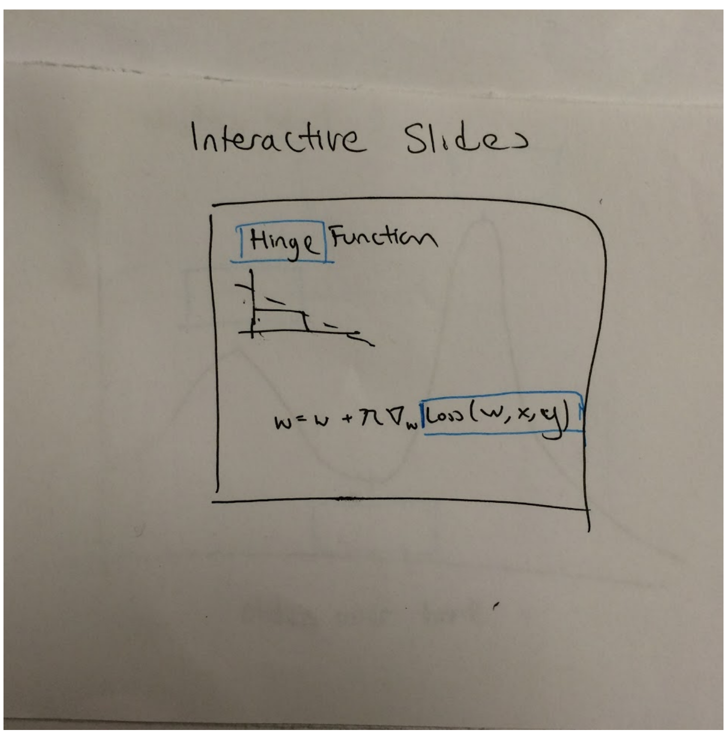
version	specific -Encourages students to think critically about material presented -Crowdsources quality of questions asked -Professor can see what most students are confused about and fixed questions in class -Silent if you want it to be	participation to kickstart the question process -Professor has to follow along	
Slide interactivity on the desktop ("heat map")	-Robust & accurate interaction with content -Very specific feedback	-Live interaction is hard - Possibly easier if adding on to Google Slides	Yes

Sketches of important screens

(see figures 5.2, 5.5, & 5.6)

Figures

5.1 Interviewing Percy Liang during CS221 office hours



5.2 Interactive “heat map” slides

5.3 Interviewing Aditya Srivatsan as he demonstrates classroom behavior & note-review

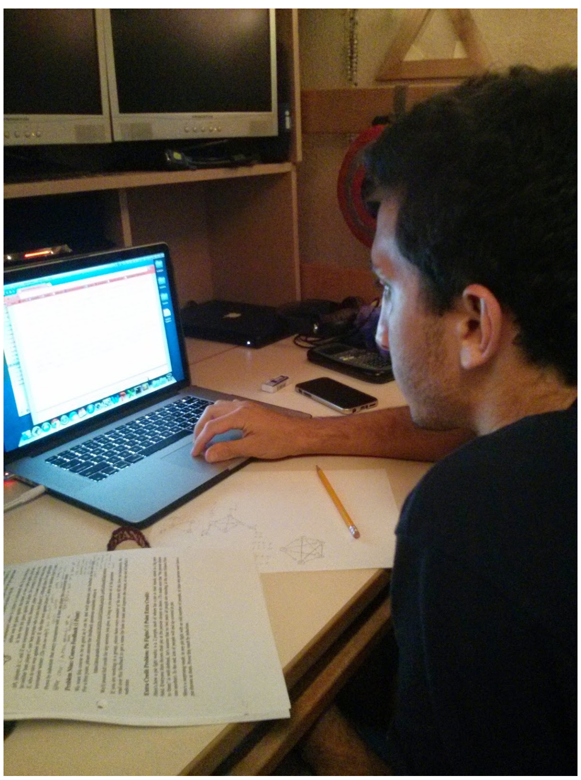


Figure 5.4 Interviewing Nick as he reviews lecture slides

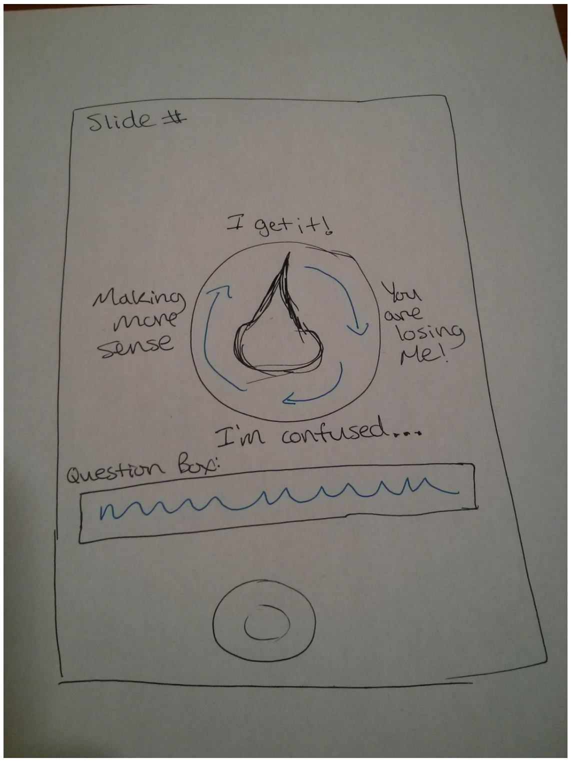


Figure 5.5 Sketch of mobile understanding app with live analytics

Figure 5.6 (below) Sketch of PowerPoint heat map with Professor analytics view