

lecturefy

Daniel Hok - Development & User Testing

Juan Posadas Castillo - Design & Development

Jennifer Farman - Team Manager & Documentation

VALUE PROPOSITION

To create a simple and user-friendly way to make lecture a more effective learning tool.

PROBLEM & SOLUTION OVERVIEW

Lecture is the main tool that students use in the education system today, but is lacking and is less effective than it could be. Students can raise their hand during lecture, but there currently is no easy way for them to communicate their concerns with the teacher, especially in a large lecture hall. Furthermore, the professor would have trouble shaping his or her lecture without knowing how the students feel during the class. To help solve this issue and allow students to utilize lecture to a fuller potential, this project will allow students to give real-time feedback to the teacher in a simple, non-distracting way. It will also make these opinions be more encompassing of the entire class rather than simply those who decide to speak up during lecture.

CONTEXTUAL INQUIRY CUSTOMERS

JB – Student, 18-25 years old, junior at Stanford University majoring in mechanical engineering. He is most interested in physics mechanics, but he also has taken a wide variety of other engineering classes at Stanford. He is very interested in airplanes, whether it is about the actual objects that compose one, designing how they work, or the physics behind why they are able to fly so quickly through the air. Additionally, he has a lot of experience both in attending lectures and in watching them online from home because of the classes he has taken in the 2 years in college as well as before college. JB was recruited as a friend and close neighbor of an interviewer and was glad to be of help. Typically, JB goes to all of his classes, but since he was sick recently,



Figure 1. JD's working environment

he decided not to go to class and instead watched the lecture online. For our interview, he watched a lecture in AA 100: Introduction to Aeronautics and Astronautics which is taught by Marco Pavone, and our interviewing team asked him to speak his thoughts during the video. We also continued asking him what he was thinking during the lecture and what he would probably have done if he were in the classroom in person. Julio is a good customer for our product since he has strong opinions on the lectures, but is sometimes hesitant in a lecture setting to be vocal.

KC – Student, 18-25 years old, Computer Science coterminous at Stanford, friend. Recruited due to his enrollment in several courses that make use of video lectures. I observed him watching a video for CS 224W on his phone while he took notes on the lecture. While he watched the lecture and took notes, he relayed his thoughts about the lecture and the course material. As a CS coterminous, he has a strong technical background, including extensive programming experience, and utilizes a variety of digital platforms for school as well as for leisure. He is also a course assistant for CS 103, which means that he needs to keep up with lectures and assignments for that class in order to be an effective TA. KC presents an ideal customer due to his busy workload as well as his use of online lecture videos as a major facet of his Stanford learning experience.

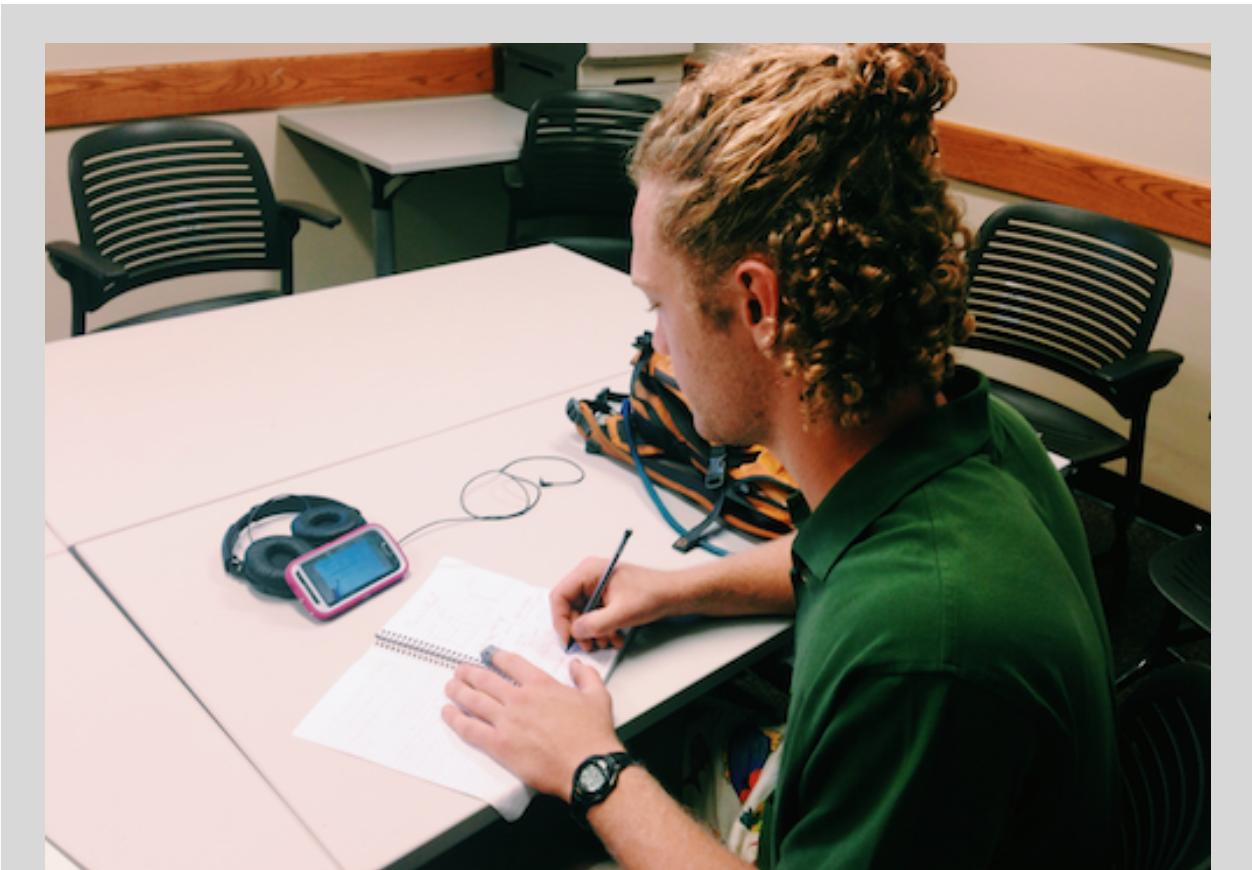


Figure 2. KC's working environment

JD – Student, 18-25 years old, MCS undergrad, CS coterm, RCC in Durand. JD was asked to participate in this Contextual Inquiry because of the several lecture videos that she watches for Computer Science classes such as CS 145, CS 229, and more. The classes that these lecture videos belong to are composed of a large number of students, making student-faculty interaction more challenging. As a programmer, JD has a very technical background, and has plenty of experience as a Software Engineer, and usually likes to multitask, even when watching recorded lecture videos. JD was observed in Durand's living room by our testing team while watching a CS 299 problem session video by Professor Andrew Ng. JD usually watches lectures in common spaces. We learned from JD as she was able to speak out loud her thoughts during different parts of the lecture such as introduction, each problem, etc. We asked JD how she felt when there was something she didn't understand properly, and what sort of tools she would hope to have in the moment to make her learning experience better. Overall, JD did a great job, in partnership with our testing team to address student issues during online lectures, and ideas to leverage lectures for student learning. JD is an ideal customer for the application because she is eager to express whether she is lost or not during lecture.



Figure 3. JB's working environment

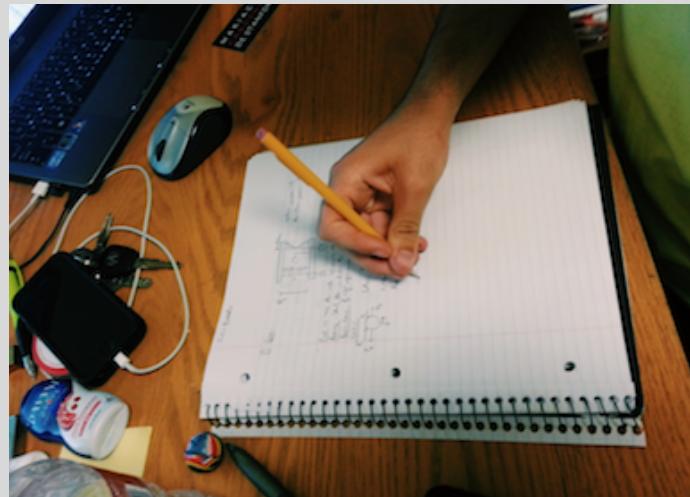


Figure 4. JB's lecture notes

CONTEXTUAL INQUIRY RESULTS

All of the participants used online lecture videos to learn the material being presented in their courses, and all took physical notes in a notebook as they watched. All of the participants took notes on the slide content and any information written on the board during lecture. JD and KC both drew out some of the diagrams and graphs that appeared on the slides of their lecture videos. The participants all took their notes with the intent to revisit and reference them when working on assignments or reviewing for exams later on in the quarter. The participants all expressed concern for staying up-to-date with the lecture videos. KC, for example, stated that although he usually likes to watch the lecture videos

the same day they are recorded, he often falls behind on watching the lecture videos. However, all of our participants noted that they are usually no more than a day or two behind when it comes to keeping up with lecture.

The participants all expressed a variety of negative sentiments about the pace, format, or content of their lectures. For instance, JD commented that she wished he could find the slides at the beginning of the class so that she could reference them before beginning the video. She also expressed an interest in seeing the lecture topics organized in an outline format. Although all participants had concerns about the content or organization of lecture, none of the participants expressed an interest in relaying their concerns directly to the professor. Both JD and KC stated that they were confused by some of the concepts presented in the videos they watched. Despite these concerns, all of the participants believed that watching the lecture videos was worth their time.

The participants also jumped back and forth to different portions of the lecture video when they wanted to reference information presented earlier in lecture. They both also had a difficult time finding the relevant part of the lecture video that they wanted to rewind to, and both spent a non-trivial amount of time skimming through the video to find the desired portion of the lecture. KC noted sometimes he stops watching a lecture video and then goes back to finish watching it later in the day. In these instances, including when I observed him, it takes him a while to figure out where he left off in the lecture video. He references the lecture slides and leafs through his notes in order to skip ahead to the desired portion of the lecture video. Phones presented a distraction for JB and JD, who both played with their phones at various times while watching their lecture videos.

Thoughts on individual inquiries:

Each individual had a unique preferred location and setup for watching lecture videos. KC was the only participant to use a mobile device to watch lecture, and most often watches lectures on his phone when he has free time between classes and other on-campus commitments. KC stated he watches his video at “lots of times and lots of places,” and noted that his phone allows him to watch lecture videos “wherever.” JD prefers to watch lecture videos in a common space such as a dorm dining hall or a library study room, while JB uses his bedroom desk as the staging area for these tasks. Unlike the other participants, JB made use of a large desktop monitor to watch his lecture videos. JB noted that when he attends lecture in person, he uses a tablet with a stylus to take detailed notes in lecture.

Unlike the other participants, who jumped back and forth through the lecture video, JB was the only participant not to pause or rewind at all while watching the lecture. JD expressed the most negative feedback about the content and organization of the lecture video. Although JD stated she would relay her concerns through a system of anonymous feedback, she was adamant that she would not want to have her name associated with any negative comments about the course. When KC was confused, he would pause the

lecture to zoom in on his phone and study the graphs and equations more closely. KC would also pause the lecture to leaf back through his notes from previous lectures.

STANDARD TASK ANALYSIS QUESTIONS

Who is going to use the system?

After observing our participants during our Contextual Inquiry exercises, we believe that the main customer sector are primarily students who have lectures that are recorded and available for watching on an online platform. Most of the people we interviewed use an already existing online platform for watching lectures, but we noticed that there is a lack of resources and materials that they all wish they could have, and which lectures videos can help leverage. At the same time, professors, lecturers, and other teaching staff will also be able to use our system. This would serve as a platform for the staff team to provide more information to the students by integrating a questions and answers system, a connection between textbook reading sections and lecture, guidelines and outlines for the entire lecture and the ability to provide feedback, a stronger binding between assignments and material that has been covered in lecture and in readings, etc.

What tasks do they now perform?

Through our Contextual Inquiry observation, as we started to test the user while watching recorded lectures online, we noticed that many students went back and forth between different windows such as a word document to write notes and important details, then back to the lecture itself, to a new browser tab to look information they didn't understand during part of the lecture, to their phones when they felt like the material was unimportant. One of our test cases, Kevin, who prefers to watch his lectures on his mobile device, showed that there was confusion when asked to return to the section where the student had left off from a previous lecture viewing session. The student ended up going through his notes trying to find where he had left off, slowing down the learning process. Students usually also go to Piazza during lecture to find relevant questions that might be covered in lecture and that might be useful for the assignments. This usually distracts the user from lecture as he has to switch windows and traverse down a large and very bad structured list of questions and answers.

What tasks are desired?

Our customers suggested many features that they would like to have while watching lectures. A couple of them indicated that having some sort of outline of what is being covered currently in lecture would be a great tool to not feel lost, or to be able to skip to the parts of lectures that they would want to review, rather than guessing or going through the whole lecture. One of our customers, Jessie, also suggested that it would be great if she could give some feedback to the professor anonymously regarding a section of lecture, and the ability to up-vote other students comments and concerns. Another customer also state that it would be great to be able to efficiently find textbook pages relevant to the material being taught. Another student also suggested that we make lecture

videos more mobile friendly, in order to be able to perform their usual tasks at any point and have access to these materials everywhere.

How are the tasks learned?

Our contextual inquiry customers learn tasks through trial and error. Finding an efficient method for taking notes and engaging with course materials is often a matter of personal preference and habit. This comes through years of experience at Stanford, and it becomes a routine for students who watch online lectures. Customers, liked JD, expressed feedback out loud, something she would usually do in her head. These feedback exercises that we asked our customers to do were tasks that students usually do along their education, and that should be taken more into consideration.

Where are the tasks performed?

Tasks are performed in a number of places. For KC, who watches lectures on his phone, tasks are performed in a number of places across campus. For the other participants, tasks are generally performed at home, in the library, or in another quiet study space.

What's the relationship between customer & data?

When it comes to lecture videos, there is not a wealth of data available to our customers. Lecture videos are usually posted on SCPD by date, with little other information about the lecture. At the same time, data about questions posted by other students is available in a complete different platform such as "Piazza", and are not very well sorted or linked to the relevant topic in lecture videos, etc. Feedback is also relevant for professors and staff, and usually this data remains within the student, as students don't have an optimal way of sending their feedback during in-lecture sections. This also represents the gap of data that there exists between data that the customer has and the teaching staff.

What other tools does the customer have?

Most of our customers did use extra tools while watching online lectures that helps them accomplish our tasks. For example, our customers used Piazza to post their questions and concerns about assignments, lecture, etc, without any order or sorting whatsoever. While trying to keep track of valuable information in the lecture, the always useful "pen and paper" worked for them.

How do users communicate with each other?

Our interviewees showed concern in being able to communicate easily with the teacher to improve the usefulness of the lecture for them. All of the interviewees complained about some aspect of lecture, whether it was about not being able to hear the instructor or how they wished that the instructor would talk faster or slower depending on how complex the concept was. This, however, would be terribly difficult to get across because of the setting in a lecture hall. In that situation, the only way for a student to get the attention of the lecturer is by raising his/her hand during lecture and hope to get noticed and called on by the professor. This can be intimidating sometimes because lecture halls can have hundreds of students in one room, so it can feel frightening to take up the time of

everybody in the classroom and focus on the topic you have in mind. When online, communication can be very limited to a slow process where the student would have to wait a while before receiving an answer, such as in discussion forums like Piazza. Emailing the lecture staff is another option, but even that can be intimidating and is much more formal than speaking to them after class or in a forum post. In lecture, students could only speak to their neighbors quietly during class if they are confused or through other social networking, but both of these options are very inconvenient and would cause them to miss the actual lecture. With this product, students should be able to communicate and express ideas with the teacher in a more seamless way that would allow participation to be all-inclusive in regards to the class.

How often are the tasks performed?

Students attend or watch lectures depending on the number of classes in their schedules they pick at the start of each quarter or semester. For JB, his schedule is pretty varied among classes in lecture halls, sections in small classrooms, and athletic classes. He is also the kind of student who feels he must attend every lecture or else he would fall behind quickly in his classes. Others, like JD, are more accustomed to watching lectures online because they end up doing that a decent number of times per quarter and are more likely to skip classes and make up for it later. Ultimately, though, the number of times a student goes to lecture or watches it online depends on the course load of the individual - if he is only taking 12 units that quarter, then most likely this task will happen often versus the opposite happening if he is taking 20 units.

What are the time constraints on the tasks?

The time restraints of the task are confined to the length of the lecture if the student attends the lecture. He would be able to communicate with the professor, typically by raising his hand and asking a question, as long as he is present and able to get the attention of the teacher. When watching a recorded lecture, the only time constraints are how long the video is going to be on the website because then the student would have to watch it before it gets taken down. For the most part, this is until the end of the semester or quarter, but it may vary depending on the class and teacher. Class feedback is usually administered at the end of the quarter or half way, which means professors are not able to receive adequate information about their students in time to make a change.

What happens when things go wrong?

If a student is unable to ask a question during lecture or after lecture, he remains lost on the concept and it may be difficult to catch up after this. Additionally, if the student has trouble connecting the lecture with other tools (forum posts, textbook, etc.), it may take away valuable time from the student's studying. Also, this concept may build on top of itself in other lectures and snowball into a continuous problem where the student constantly is confused during class. This may ultimately lead that student to ask more questions in the future or else cause him to perform poorly on the assignments and tests due to a weak foundation of the information being taught. A way to remedy this, as Julio described, is to look up the specific question and read an article that explains the topic.

Best Application Ideas

	Significance	Feasibility	Interest
Time-stamped feedback system	Allows for users to express their exact thoughts at specific times of a recorded lecture and ask questions that would immediately have a point of reference. It is an effective way to clear up confusion on lecture topics.	The idea requires that the professor contribute a lot of his or her time online to answer such questions and annotate the lecture with specific information. It is definitely possible, though.	This would greatly increase the value of recorded lectures and would make re-watching lectures to review a very good study tool. It also allows students to look up facts much more efficiently.
Real-time lecture feedback	Lets students immediately provide feedback for teachers in class and steer the way for the rest of lecture without requiring to call out the teacher during lecture. It is also helps give a voice to those who are more timid in classrooms.	Requires students to redirect some of their attention away from the teacher's lecture. It also requires that each student have one of these devices, which may be difficult to get in every classroom. The most feasible way to have this is through a smartphone app.	Would greatly benefit those who feel intimidated in a large lecture setting. Allows for an ongoing system for teacher feedback so that they wouldn't have to wait until after mid-quarter evaluations for changes to happen.
Integrated learning platform	This application allows users to have all the resources and assignments properly linked with the lectures themselves and, by association, with each other. Students wouldn't need to traverse through link and try to find which part of lecture is covered in an assignment and which pages in the textbook correspond to the assignment.	This idea requires teaching staff to populate information such as the outline of lecture in advance, the slides, the parts of lecture which correlate to specific questions in an assignment. Students would be the ones providing the questions and feedback, which would be time-stamped with the time of the video where it happened.	It would benefit all students who watch online lectures, since it brings together all the tools that students use. Though it will require an initial bigger effort to supply the information which links lectures with assignments, questions, etc; it is still in the best interest of the teaching staff to make learning a better experience for students.

TOP APPLICATION IDEA

Our team has decided to chose the “Real-time Lecture Feedback” as it presents the most efficient and innovative solution for immediate interaction between students and professors. We picked this idea because it also presents a potential for growth into a more robust lecture analytics application, giving even more data to professors to make the lecture experience better. At the same time, this applications has the potential to be used in many different platforms that are currently used by students and lecturers.

REVISED TASKS

1. Clarify questions and solidify understanding of course topics [moderate, moderate frequency, high importance]

Through our Contextual Inquiry and Task Analysis results, we were able to identify that students were confused throughout different parts of lecture. This is very important in order to have a better understanding of the overall concept. Students, who are willing to give feedback, really would want their questions and concerns clarified in a more responsive manner. Currently, these clarifications happen during Office Hours, on Piazza, or between students. Through our solution, professors would have a more rapid access to student feedback.

2. Influence pace, content, or organization of lectures [complex, high frequency, medium importance]

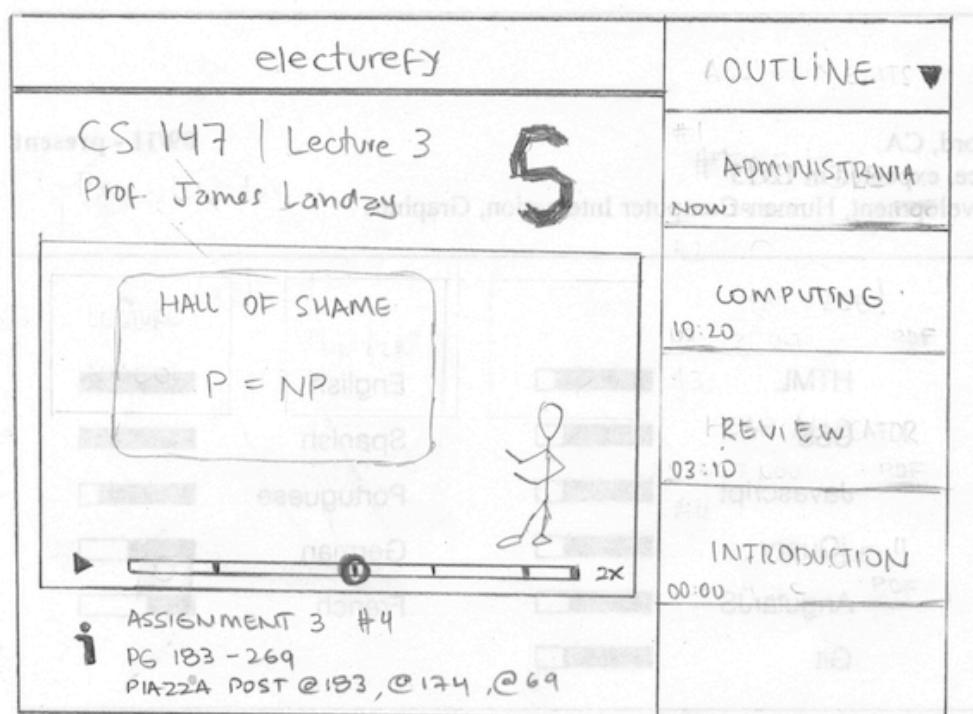
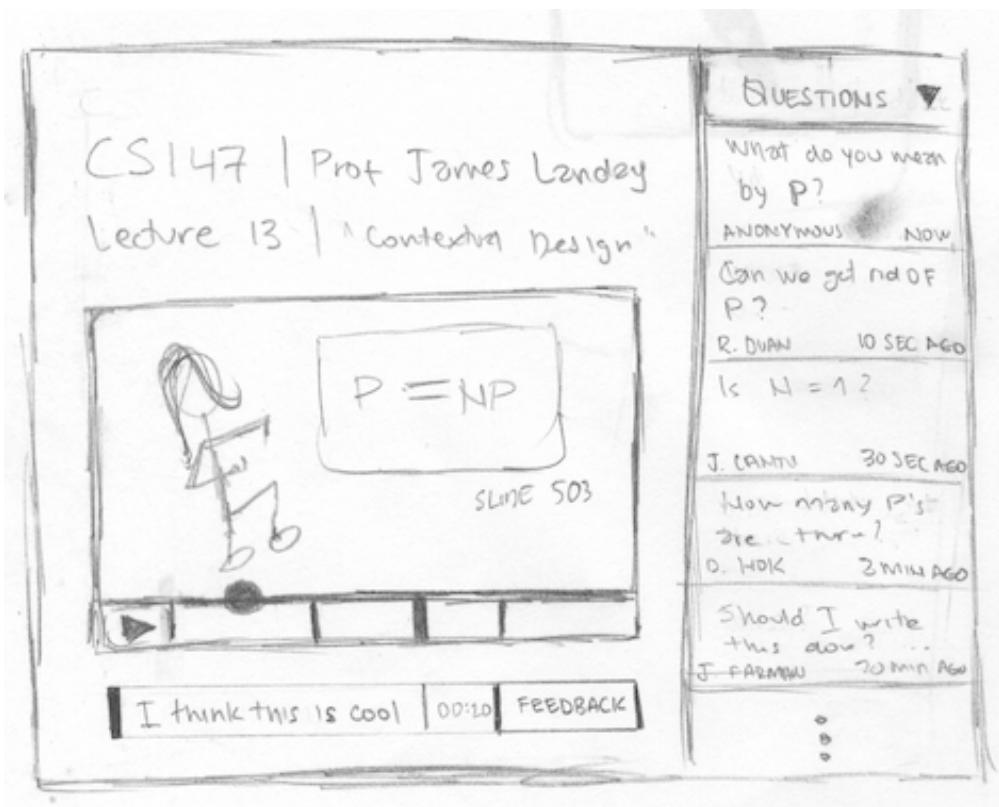
Our research team has identified that students have a lot of feedback to give. In a way, we are trying to serve as a tool to give students the ability to influence their learning process, and be more active throughout it. This becomes a complex task, because it would require students to engage with lecture and the professor in a higher frequency. At the same time, professors or lecturers would have to pay attention to the overall in-class performance, which requires an effort to give better lectures and be more engaging. Overall, a higher participation from both ends is what will leverage lectures during the learning process.

3. Stay up-to-date with lecture videos and course materials [simple, moderate frequency, moderate importance]

The students wanted to make sure they didn’t fall behind in lecture content by watching any lectures they might have missed. Also, they would typically work on the relevant homework and other materials on that topic around when they learned the material. In the task analysis, the contextual inquiry participants did express concern about staying up-to-date with the class lectures. They can do this by either attending lecture in the lecture hall or by watching online after the class has finished and the video has been posted online. Although this task is useful, it isn’t mandatory since it builds on top of the other tasks; students are still able to fall behind on lecture and still finish other tasks.

DESIGN IDEA SKETCHES

Design Idea #1 - Time-stamped feedback / questions



Design Idea #2 – Integrated platform for course materials / feedback

EXAMPLE 4 Obtaining a MacLaurin series by differentiating a known series

Find the MacLaurin series for $\cos x$.

intuition We could proceed directly as in Example 4, but it's easier to differentiate the MacLaurin series for $\sin x$ given by Equation 13.

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

$$= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!} \quad \text{for all } x$$

The MacLaurin series for $\sin x$ is given in Example 4. Let's find its derivative, using the same methods. In Newton-Raphson's method, we used derivatives to find the roots of a function. Let's do something similar here: we'll take the derivative of each of these functions if we know all its derivatives at the origin (Section 3).

$$\cos x = \frac{d}{dx} (\sin x) = \frac{d}{dx} \left(x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots \right)$$

$$= 1 - \frac{3x^2}{3!} + \frac{5x^4}{5!} - \frac{7x^6}{7!} + \dots = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

Since the MacLaurin series for $\sin x$ converges for all x , Theorem 2 in Section 6.6 tells us that the differentiated series for $\cos x$ also converges for all x . Thus

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

For more on this topic see:

- Lecture 09/21/14 on [SCPD](#)
- A Guide to Functions ([pdf](#))
- Question #142 on Piazza

The power series we obtained by indirect methods in this section is called the Taylor series for $\cos x$. Section 6.6 are indeed the Taylor or MacLaurin series of the general form

Video: Monday, September 29, 2014

For more on this topic see:

- Textbook section 1.7 ([p. 285](#))
- PSET 3, Problem #2
- [SQL Practice Quiz](#)
- Question #142 on Piazza

Stanford

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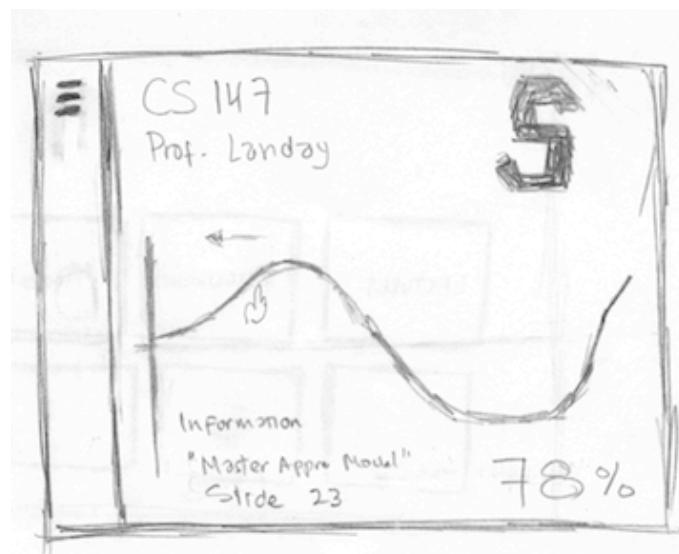
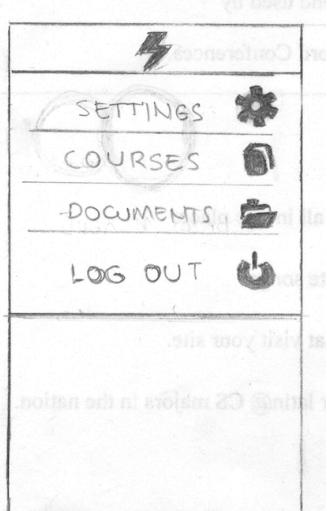
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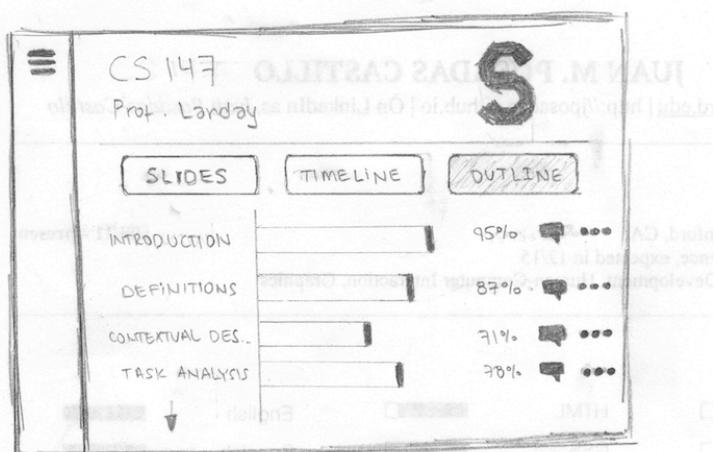
ASK A NEW QUESTION

type your question here...

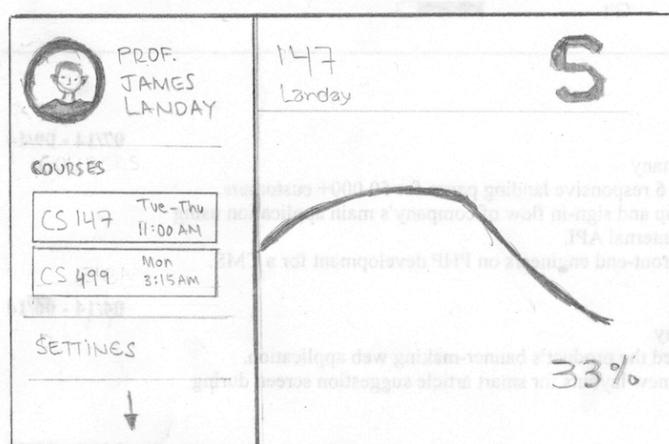
Design Idea #3A – Real-time lecture feedback



Lecture Overall statistics



CLICKING ON MENU BAR



Design Idea #3B – Real-time lecture feedback

Class Comprehension

Time Remaining
00:12:24

■ Confused □ Understanding
44% 56%

▼ People Confused

Time in Lecture

Teacher Feedback

- I really like your class but it is very hard.
By: Joe Smith 10/10/12
▲ 30 ▼ 2
- Class today was interesting.
By: Jack Black 10/15/12
▲ 20 ▼ 0
- I didn't like the homework.
By: Anonymous 9/30/12
▲ 14 ▼ 9

Post new comment here...

Name:

Lecture 10/1/12

▼ People Confused

press

Time in Lecture

P ? = NP

Lecture 10/1/12
42:10

Career

▼ Understanding

Time in lecture

Career

▼ Faster

Time in lecture

Design Idea #3C – Real-time lecture feedback

