

Contextual Inquiry and Task Analysis

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Problem & Solution Overview

When a college student is faced with a confusing point, they confront a jungle of resources to cut through. The student must negotiate a path to knowledge, whether through Google, Piazza, the course site, office hours or asking friends. These are too many hoops to jump through, just to clarify a simple misunderstanding.

On the other side, the instructors have a closely related problem. They spend hours clarifying the same concepts over and over again, within office hours, through emails and on Piazza. Office hours, especially, can become a torture. Before deadlines, office hours are packed, the queues are long and students are unable to receive the personal help that they need. In other times, they are empty and TAs waste their time.

We found that the most pressing problem, therefore, is the lack of feedback between instructors and students on what is working for the students' understanding and what is not. We hope to optimize the current workflow for answering students' questions and to gather important student feedback so instructors are better able to plan office hours.

Value Proposition

kindergarten will provide instructors with a simple and quick method for gathering feedback and questions from their students.

Contextual Inquiry Customers

Our targeted customers are Stanford undergraduates and Stanford instructors, who include graduate Teaching Assistant and professors. For our contextuaty inquiry interviews, we try to get an interview with each type of customer.

The Professor



We observed Professor Percy Liang, 30 - 35 years old, as he conducted CS221 office hours in Gates and asked him followup questions about how he conducts his office hours and approaches redundant questions. On the day that we interviewed him, another TA was hosting his office hours at the same time, so there were only a handful of students in his office hours. Hence, he used a queue to answer each student's questions, but encouraged all the students to come into his office hour to listen to his explanation and even contribute when appropriate. When there are a lot of students, he will group students by questions and answer each group's questions. If there are common conceptual question or clarification questions, he will even change his slides and post a clarification notice to Piazza. During our interview, Professor Liang noted that gathering student feedback and incentivizing students to give feedback is huge problem. To address these issues, he coded and incorporated interactive Javascript slides to his lectures. On each slide, there is a *thumbs up*, *thumbs down*, and *give feedback* button for students, so students can directly report which part of lecture confused them. He recognizes that each student learns differently and that gathering targeted student feedback is crucial to customizing the

course to each student's needs, but at the same time he has had trouble incentivizing students to provide feedback.

The Student

Note: Maneesh Apte didn't want his photos to be taken.

We interviewed Maneesh Apte, a student in CS107, as he worked on an assignment at the Stanford Law School. Unfortunately, he did not want to be pictured. Whenever he encountered a bug or had a question that he could not find the answer to online, we would talk to him about whether or not he would post the question on Piazza or wait to go to Office Hours to look at it with a TA. He told us that, for most serious questions, he greatly prefers going to Office Hours because you can have a conversation with the TA and figure it out together. His only complaint about Office Hours is how crowded they get right before an assignment is due. He reported going to Office Hours for a class two to three times per week depending on the difficulty of the assignment that was out. He also said he posts on Piazza four or five times a week but only feels satisfied with the TA's response about 80% of the time. Interestingly, we noticed that when we posts on Piazza, he never looks to see if someone else has posted the same question.

The TA

Note: Ben Zhou didn't want his photos to be taken.



We interviewed Hart Goldman, a senior in Physics and TA for Physics 70, as he held section-cum-office-hours for the class. He doesn't use Piazza or anything more technological than email to answer questions. Questions asked by the students, because of

the topic's complexity, often turn into short lectures: often, only the student who asked is listening. But the goal of the answers are nearly exclusively to teach the physio-spatial intuition that is not taught by the formal symbolic reasoning of the class, because the specific topic (general relativity) was so unintuitive. This is why he lectures, and often questions the questioner about *their* intuition. Hart teaches for the experience, but he is not particularly invested in the teaching, because he knows he will be evaluated for the quality of his research, and it is only if his teaching is egregiously bad that it will harm him.

We also interviewed a student in physics 70, Ben Zhou.

Other interviewees: Firas Abuzaid (CS145 Head TA), Kevin Crain (CS103 TA).

Contextual Inquiry Results

The essential process, which we were acting as apprentice of, was answering students' questions. This is an abstract task that manifests itself in several ways, such as in office hours and Piazza, and in those domains it diverges.

The process of answering questions in office hours is nearly always an interaction, not a single question and a single answer. The question-asker asks their question, but the instructor also asks questions *about* the question. This is for clarification of the question, to try to get the student to figure things out themselves, and to figure out what the student is missing from their understanding. This happens both for Percy Liang who, having been asked a question about the CS221 project, asks questions about the structuring of the project and the data which is to be used in it until he finds a weakness, and for Hart Goldman, who being asked about a general relativity project, asks questions about the world in which the problem is taking place, to build intuitions about the world and therefore about the problem.

If more than one student is involved, it becomes more of a lecture, becoming more and more a lecture as more students become involved. At some point, therefore, the instructor may acknowledge that the other student is there but ignore them, in order to continue the interaction.

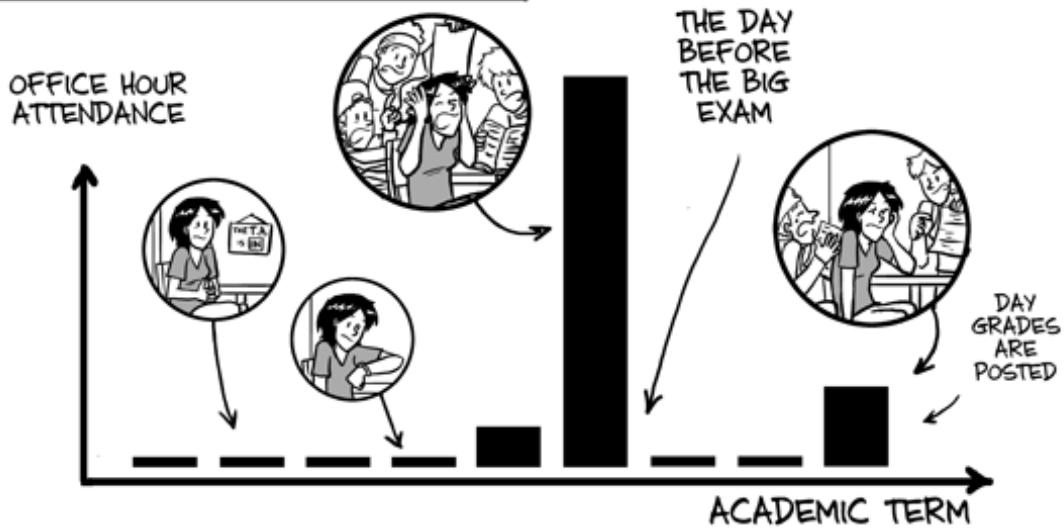
Maneesh Apte and Hart Goldman both noted consciously the phenomenon of office hours being mostly empty until they are needed, in which case they rapidly become too full, as noted in this comic:

THE PHD COMICS GUIDE TO T.A. OFFICE* HOURS

ATTENDANCE IS EXPONENTIAL:

*ASSUMING YOU HAVE AN OFFICE

JORGE CHAM © 2011



These office hours are, compared to lecture, very informal: this must necessarily be true in the interaction. Firas, because of this, uses the office hours to get intuitions about where students are at in their understanding of the material. Hart Goldman makes jokes about the professor and about the subject and makes informal evaluatory comments about the book ("this textbook was really made for self-study, so if it's weird to read it as a textbook for class, that's why").

When observing students using Piazza for questions, we found a divergence in patterns of usage: Ben Zhou did not *post* anything on Piazza ("there's nothing wrong with doing it, I just don't do it"), whereas Maneesh Apte did not ever *read* anything on Piazza, preferring to post his question immediately and go back to the question later. For both Ben and Maneesh, it was often true that the answers posted on Piazza were not clear enough for them: in this case, they went to office hours, for an interactive discussion.

Ben Zhou, Percy Liang, Kevin Crain and Firas (every interviewed person who read questions on Piazza, in other words) also encountered the same pain point with Piazza: the tagging system, search and filtering are inadequate, and so the interface they all ended up defaulting to was to scroll around the question listing, which could get quite long.

Task Analysis Questions and Answers

1. Who is going to use the system?

The two groups that will use the system are students and instructors. For students, we are focusing on engineering students at Stanford University. Instructors are graduate students and professors at Stanford University.

2. What tasks do they now perform?

Now, students attend Office Hours to get questions answered, post questions on Piazza, attend lecture and section to learn, do problem sets and assignments to demonstrate their knowledge, ask questions through email, and check for announcements on Coursework. Instructors provide Office Hours, answer questions through email and Piazza, distribute class materials through Coursework or a class website, teach material, and grade assignments.

3. What tasks are desired?

Both instructors and students desire a way to more effectively organize office hours in order to avoid situations where no one attends office hours or, on the other end of the spectrum, too many people show up and the instructor cannot help everyone. Instructors also desired a method for students to work together to answer each other's questions. Lastly, instructors desired a reliable and easy method of gathering student feedback.

4. How are the tasks learned?

If the system we create is designed well enough and is easy to use, Stanford students and instructors should be able to perform tasks through the application without any formal training. A clear UI, in addition to an explanation in the class syllabus to students regarding what tasks they can do through the service, should familiarize students enough with the application to be able to use it effectively.

5. Where are the tasks performed?

It is important to use that these tasks can be performed on the go. Students and instructors should be able to use our system anywhere, anytime.

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

Should we focus on something similar to Piazza, many students value remaining anonymous when they ask questions. Therefore, it is important that students can control whether or not other students can see their name. Other than that, customers shouldn't be too concerned about any data relating to the system.

7. What other tools does the customer have?

Students have existing tools such as Piazza, Coursework, email, and office hours for performing these tasks.

8. How do users communicate with each other?

Students and instructors communicate with each other in person after lecture, during office hours, over Piazza, through announcements on Coursework, and through email. Instructors communicate with other instructors at staff meetings, on the phone, and over email. Lastly, students communicate with other students in person, through texting, over social media, and through email.

9. How often are the tasks performed?

How often students perform tasks such as posting questions on Piazza or going to Office Hours depends on the individual student but most will go on Piazza somewhat often to check what has been posted. Instructors conduct office hours once a week. TAs check Piazza every once in a while and most professors do not go on Piazza much at all.

10. What are the time constraints on the tasks?

For the most part, students want to get responses to their questions as quickly as possible. In addition, it is important that students and instructors can use the system quickly and efficiently.

11. What happens when things go wrong?

A few different things can go wrong regarding communication between students and instructors. For example, sometimes students are not satisfied with the quality of responses on Piazza so instead of posting questions on Piazza, they simply ask friends, which can be less reliable. In addition, if Office Hours gets too crowded, it becomes less useful for everyone there because the instructor cannot appropriately address everyone's questions. Overall, when communication breaks down between students and instructors, students do worse on assignments and tests.

kindergarten will support ...

Organizing office hours

(moderate, high importance, moderate frequency)

From our task analysis and contextual inquiry, we discovered that office hours are the best format to help students to answer their questions and learn. Unfortunately, the task of organizing office hours to optimize student attendance is a moderately hard task because the instructors have to gain feedback from a majority of students before they host office hours. The current method is to set fixed office hours at the beginning of the year. The issue with this is that student attendance at office hours varies based on the timeline of an assignment. Student attendance is low throughout the week, but peaks right before a deadline.

Gathering student feedback

(simple, high importance, moderate frequency)

Creating a method to gather student feedback is relatively simple, but getting students to give feedback is a challenge. Professor Liang created interactive slides to gain targeted feedback about a student's understanding of each concept. However, getting targeted feedback is hard task for our other participants since the tools they have currently only allows them to get feedback on the course overall. Furthermore, it's hard for both Professor Liang and our other participants to incentivize students to actually give feedback, even given the tools.

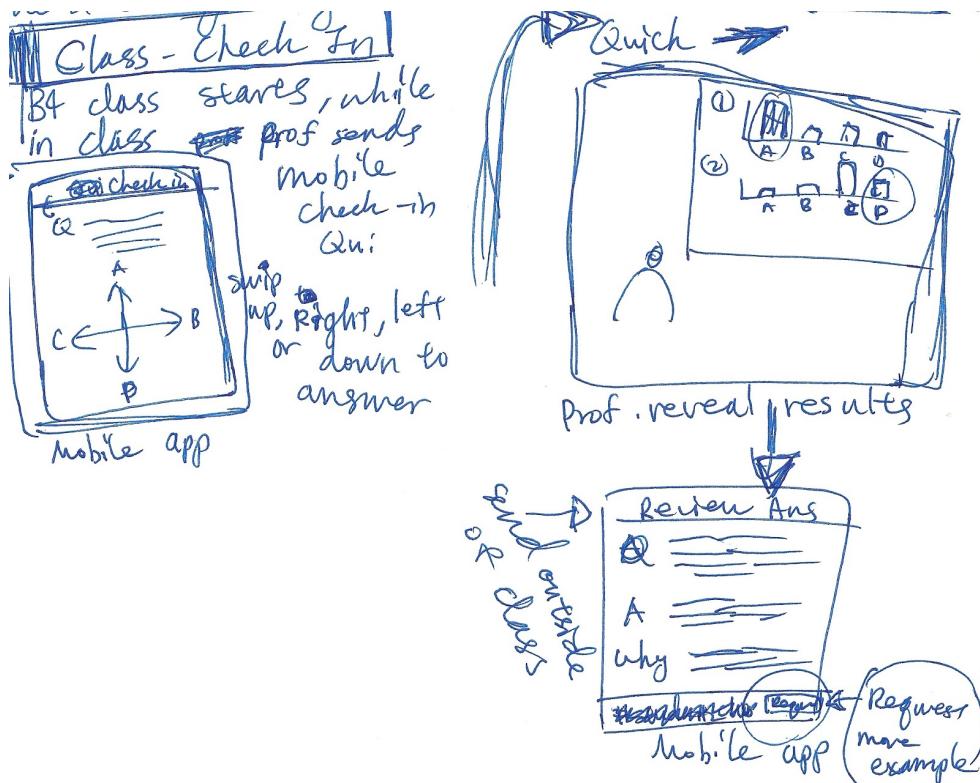
Connecting peers to promote peer-to-peer learning

(complex, low importance, low frequency)

During crowded office hours, instructors gather students with common queries to address all their questions at once and to allow students to work on a problem together. Even though this is a low priority task for both instructors and students, we recognize that peer-to-peer learning can speed up the work that instructors must do in office hours while ensuring that students receive the help they need. However, coordinating people in doing so is a complex task which requires understanding what a student needs and wants in order to make sure these student study groups are effective.

Three Best Application Ideas

1. Class Check-In



Imagine a professor who stands at her podium lecturing, phone in hand. At some opportune time in lecture, she says something like,

"So this is the intuition for the average case of mergesort. We'll go on to the next subject now: quicksort. Question."

At that word, she presses a button on her phone - and in reaction, the students pull out their phones, too. Each phone displays now the same question:

"The worst-case time of quicksort is $O(n \log n)$. True or false?"

And the students swipe their phones one way or the other, to indicate their answer. The instructor looks at her phone to see how many people got the question right, and moves on, evidently satisfied. Afterwards, those who were incorrect but curious explore the answer on the app itself.

2. Office Hours Poll

Use to schedule OH & determine order of ppl who will go OH

⊕ Incentivize students to go
⊖ Abuse

When a user clicks on an option, it takes them to the next page

How likely are you to go to office hours this week for help?

No chance
 Not likely
 Undecided
 Most likely
 Definitely

This information is used to schedule an appropriate amount of office hours.

You chose: Most likely.

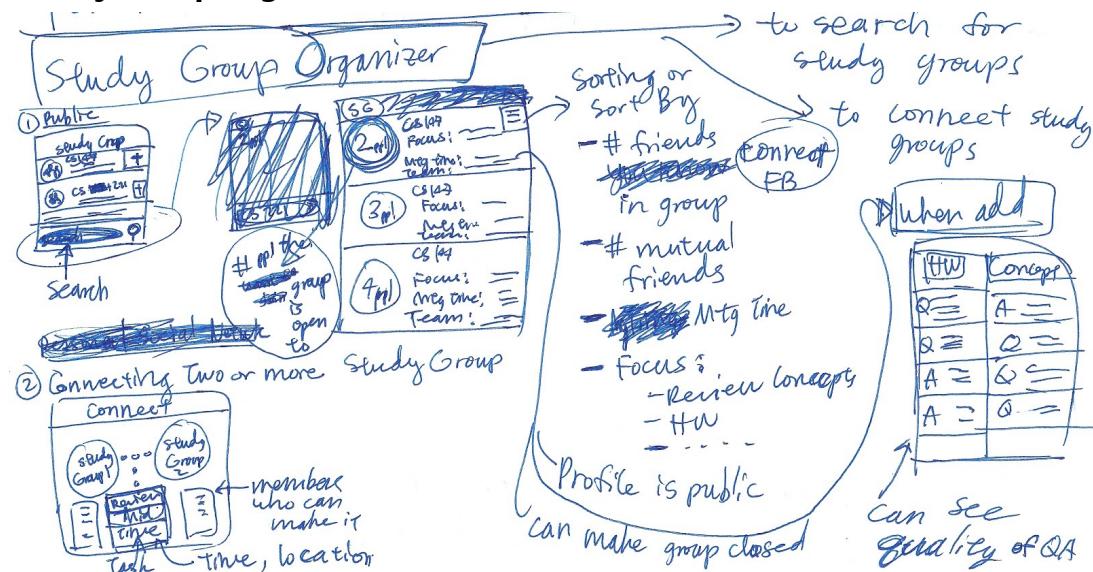
Thank you! Due to your ranking, you have been assigned number 56 in the Office Hours ranking! To retrieve this number, go to the Office Hours page from the Home screen.

← Students are given a number based on how high they ranked their need for office hours. This number is used to decide who will be seen first at crowded office hours. This incentivizes filling out the survey.

The professor lectured very well today about the origin of integral notation in the epic search for a proper formal basis for calculus, but what he did not lecture about was how to actually do the problems. When the students see the homework, they pull up the app, and notify the app that they will be very likely to go to office hours this week. The teaching assistants, seeing this, scramble to add the ones which are needed.

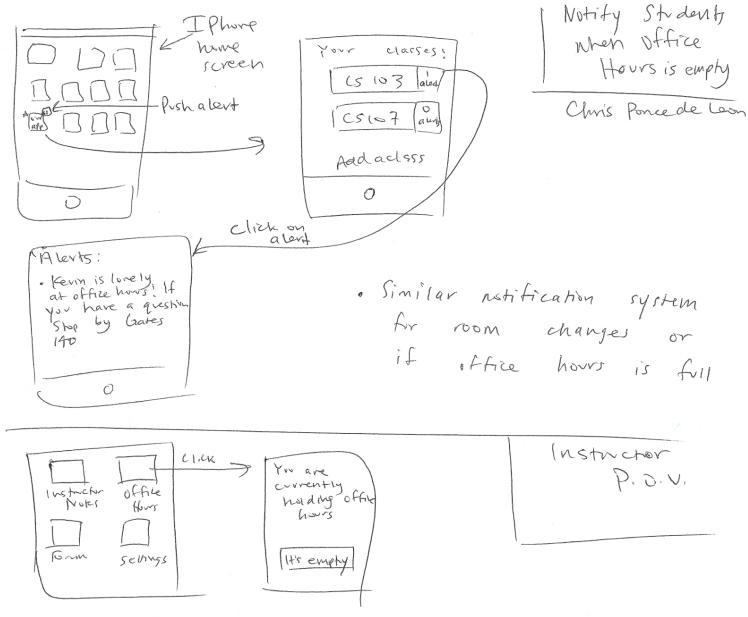
Two weeks later, the professor lectures brilliantly about the actual topic, and not a single soul in the auditorium is confused. Everyone notifies the teaching staff that they won't go to office hours this week: the teaching assistants cancel some office hours and do research instead.

3. Study Group Organizer



A student enters the classroom for the first time and feels a sinking in her heart, because there is no-one she knows in the class, and it's quite the difficult mathematics class - the kind you need a partner for. Undeterred, she pulls out the app after class: there's five other souls with the same fate. Better yet, two of those people are friends-of-a-friend. She can arrange meeting times and locations right on the app, and it can remind her of her new study group.

4. Class Notification System



A teaching assistant sits lonely at his office hours, in the liminal state where he can't do any real work because he might get interrupted at any time but he doesn't have anyone to help. Instead of reading PHDcomics.com, he can now press a button on his phone. This notifies

the people in his class that his office hours are empty: soon, three people come who had questions but were previously afraid that his office hours would be too busy.

Two weeks later, two days before the big exam, his office hours are filled to capacity. Another button on his phone, and everyone in the class knows that he has too many people: they email instead, or wait till later, and are spared the uneasy long wait.

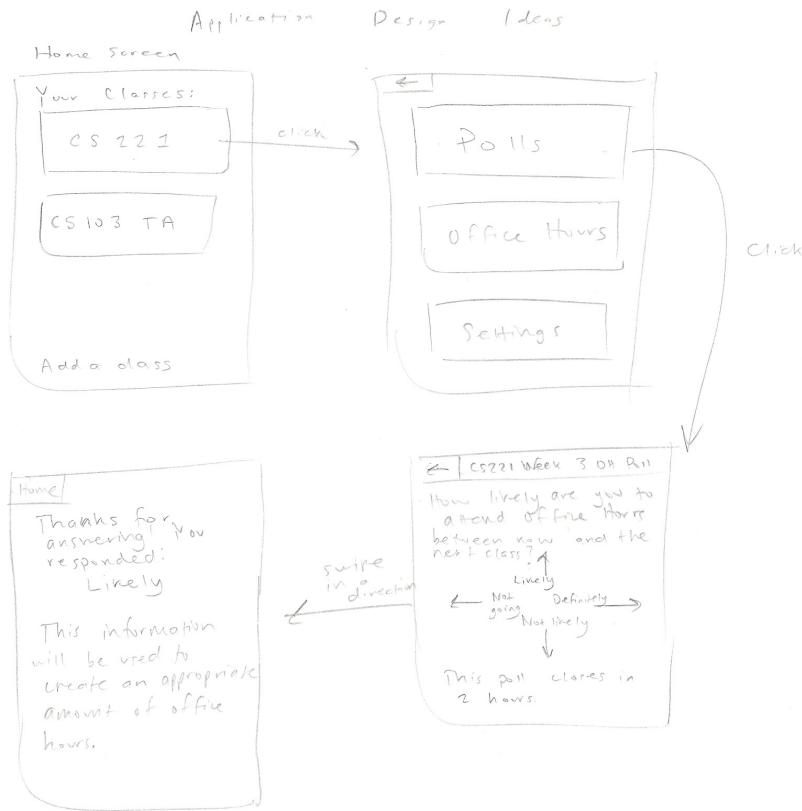
Significance vs. Feasibility vs. Interest Matrix

Application Idea	S	F	I
OH Hours Poll	Y	Y	N
Class notification system	Y	?	Y
Study Group Organizer	?	?	Y
Class check-in & (Follow Up Quizzes)	Y	Y	Y

We decided that the best idea to go forwards with the class check-in concept because of the simplicity of the basic idea, which leaves plenty of negative conceptual space to incorporate bits and pieces, scraps of the other ideas to make for an excellent product.

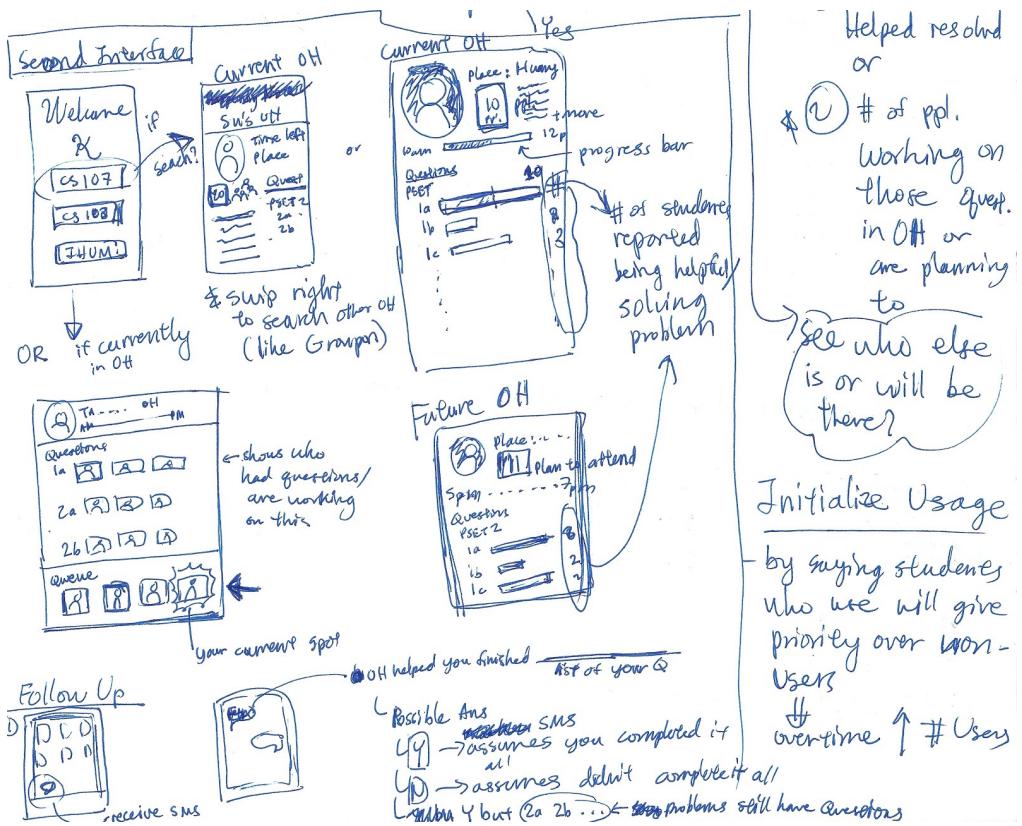
Sketches of important screens

Sketch 1



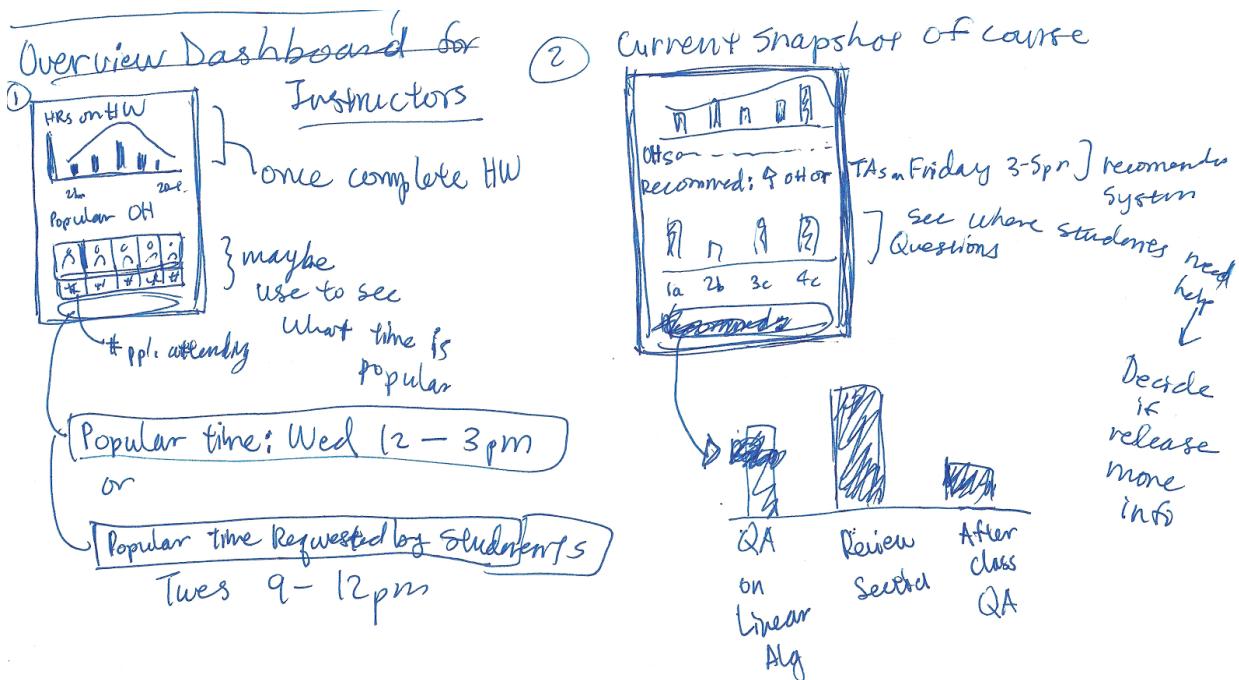
Chris's sketch demonstrates a potential course that a user could take while using the application. The home screen lists the user's classes and includes an option to add a new class. Once the user picks a class, they are taken to a screen where they can choose to either answer polls, look up information about office hours, or change their settings. Should they choose to answer a poll, a screen comes up with a multiple choice question and arrows indicating which answer corresponds with swiping in which direction. Should answers be too long to fit next to the arrows, we could consider an interface in which tapping on an arrow brings up a window with the answer that the arrow corresponds to. In the example poll shown, students can indicate by swiping in a certain direction how likely they are to attend office hours that week. After swiping to give an answer, the student is provided with a confirmation message and can navigate back to the home page.

Sketch 2



Thuy Ny's sketch demonstrates a potential office hour application. When the student opens up the app, they will see any current or coming up office hour. Besides the regular office hour information, such as the time, duration (which is represented as a progress bar), and location of the office hour, the student can see what other students are attending office hour and how many students have questions about a specific part of an assignment. To search for other office hours, they just swipe to the right. Once they choose to attend a specific office hour, they can confirm their attendance to place their name within a queue to get their questions answer or they can show at office hours and find other students working on the same problem.

Sketch 3



Thuy Ny's sketch demonstrates what an instructor dashboard might look like. It will gather important information such as the amount of time students spend per assignment, which office hours are popular, and even popular requests by students for other type of office hours.