



Homework that Helps You

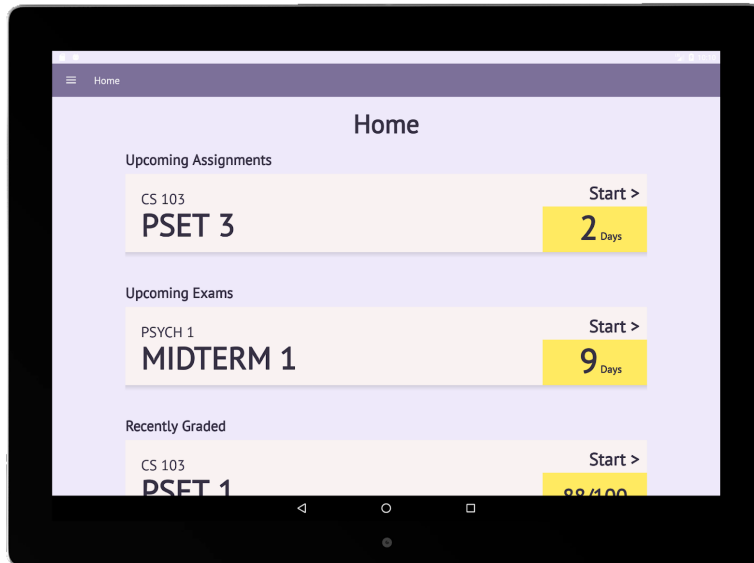
Augmented Humans Studio, CS147 Autumn 2018

Team: Richard Verdin, Aarti Bagul, Ryan Ottinger, Samantha Kim

Problem and Solution Overview

The main need we were trying to address was the difficulty to locate and access relevant resources. In our needfinding, we found that many people, students and professors alike, spent a large portion of their academic time looking up resources and scouring the web for information they needed. At stanford, many classes will have hours of recorded lecture and hundreds of slides to sift through for a single problem set. Our goal was to alleviate these pains by providing the right resources at the right time. Along with this, we found that a big issue in university came from large classes with an inability to provide personal feedback. Students are often times confused on what material would be most beneficial to study and where to look to find problems that could help them shore up their weaknesses. Therefore, we also sought to create an Artificial Intelligence that can provide individuals with relevant feedback and applicable review materials to what that individual needs. Finally, we wanted to help students connect with each other to help explain complex problems in a more personal manner. Therefore, we created a system that connects students that can mutually benefit each other to understand different problems.

We make the process of learning personalized and efficient through the use of a cleanly organized hub for all your academic needs. We seek to provide the most important information to our users up front while still providing clean navigation and resources so that they can accomplish or locate anything they might need.

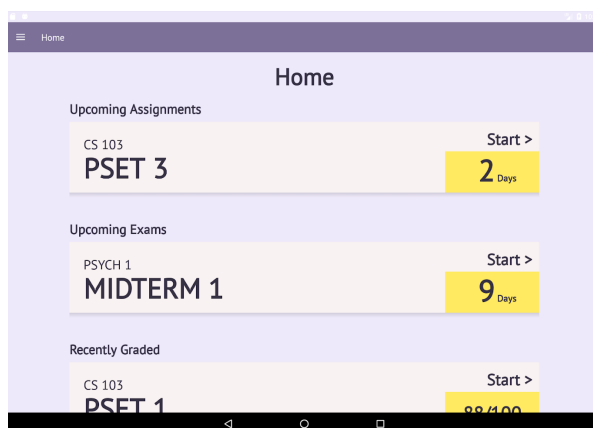


Home screen of our app

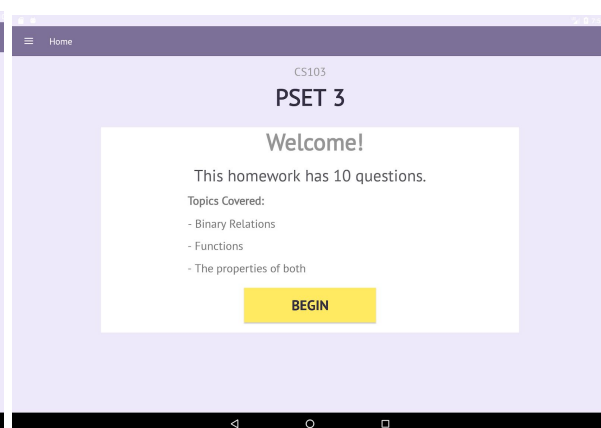
Tasks & Final Interface Scenarios

Simple: Look at an upcoming assignment and get access to relevant material

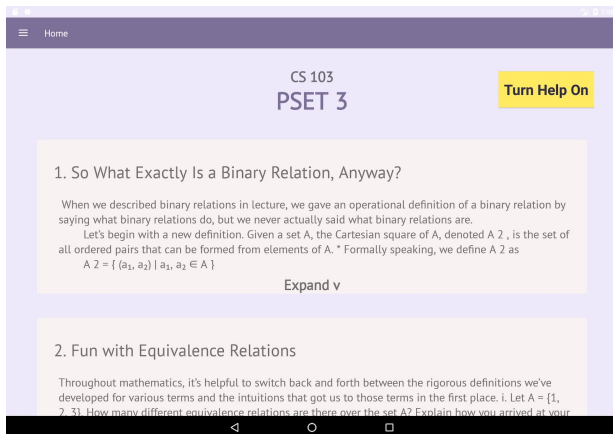
We chose this task as it covered the main pain-point we found in our needfinding. Currently, resources and information are scattered across the web with the necessary material taking hours to locate and digest. Our simple task is simply to provide those resources in a cleaner and more efficient manner.



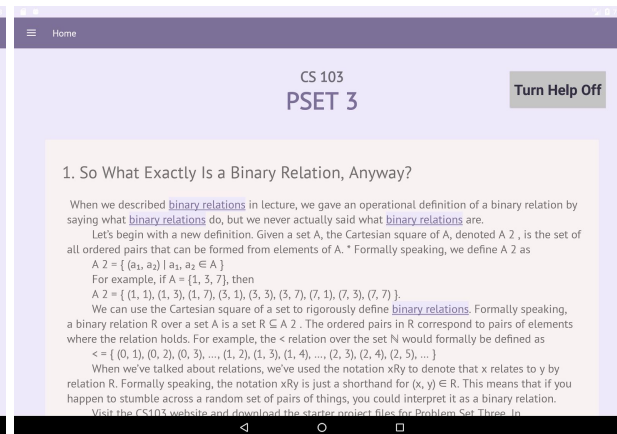
Click on "Start" for PSET 3



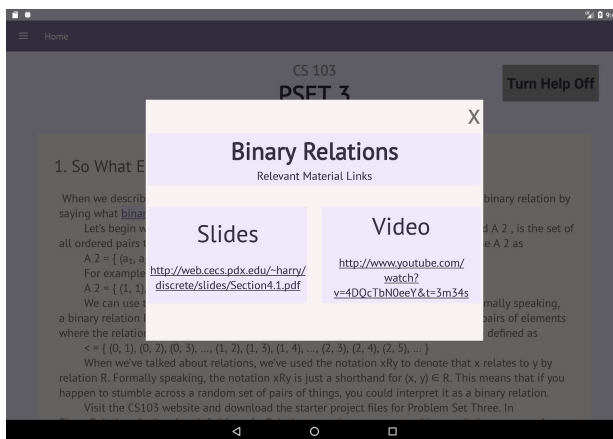
Click on "Begin"



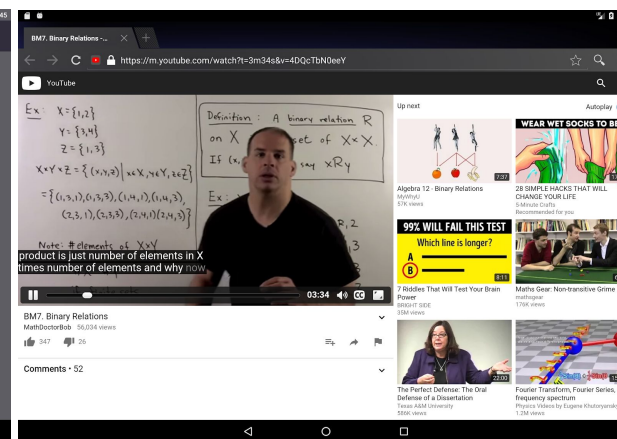
Click on “Expand”



Click on “Turn Help On” and click on “binary relations”



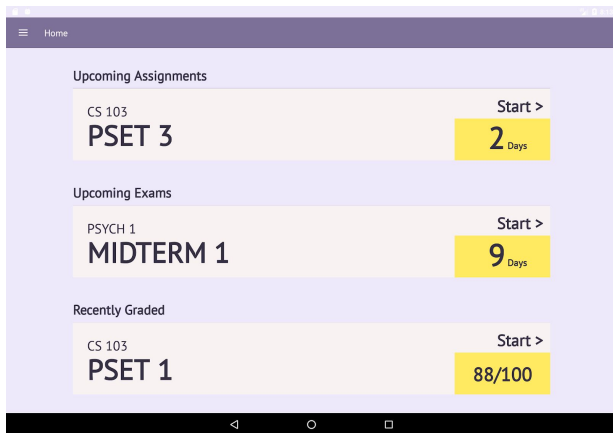
Click on the link under “Video”



Redirects to a video at the exact moment that the concept is discussed

Moderate: Review a problem that you got wrong and connect with a student who got it right

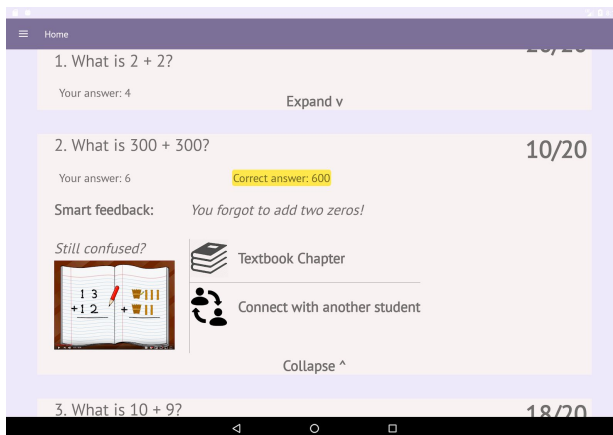
This task solves another issue we found in our needfinding which is the lack of personal feedback. By allowing students to connect with each other on problems where one student got it wrong and the other got it right, we can create personalized and human feedback systems where students will help each other learn the material and answer personal questions.



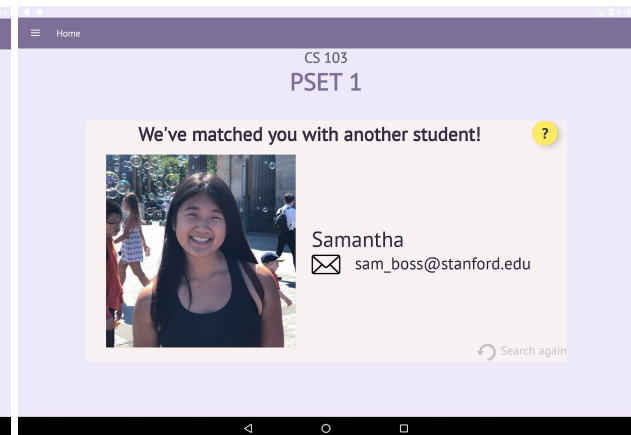
Click on “Start” for PSET 1



Click on “Expand” for PSET 2

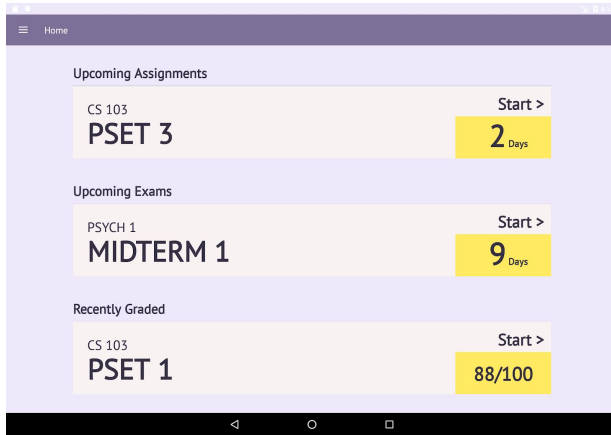


Click on “Connect with another student”

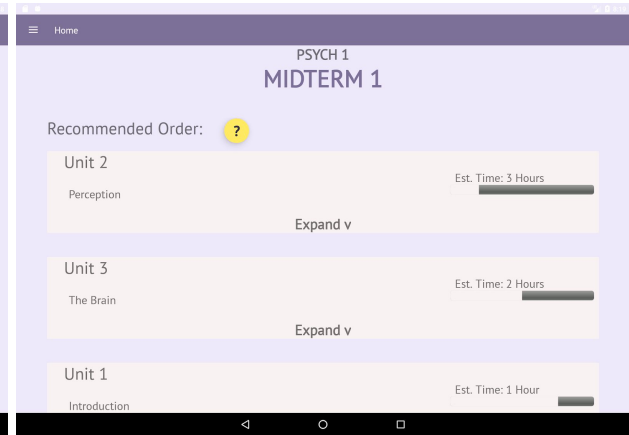


Complex: Review for a test with our auto-generated and personalizable review sheet

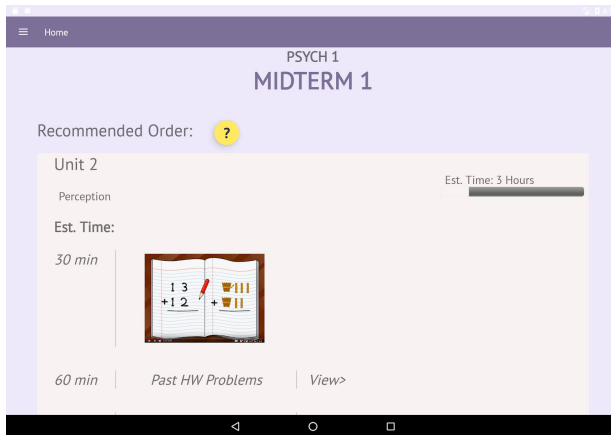
We categorized this task as complex because it requires a long-term history of use so that “our AI algorithms” could process results from previous assignments and combine this data with information on exam content to generate a tailored review sheet for the user. We chose this task as there is currently no system out there for reviewing material for exams. While sometimes classes will provide past tests to practice on, it can be very difficult to study the sections one finds hard or relearn material that one got wrong on a problem set. Therefore, this task seeks to help users create personalized study systems to help students both understand the material and get a better grade.



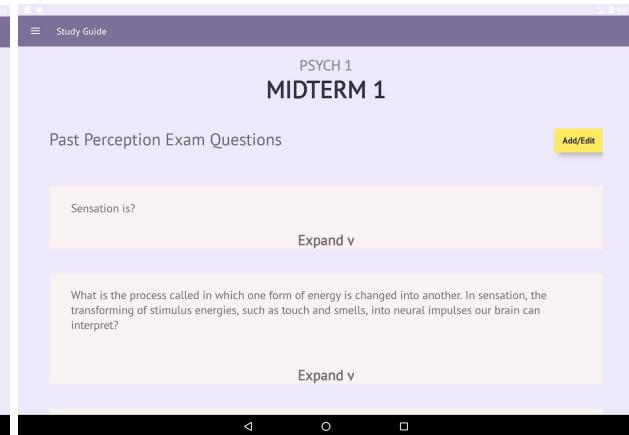
Click on "Start" for Midterm 1



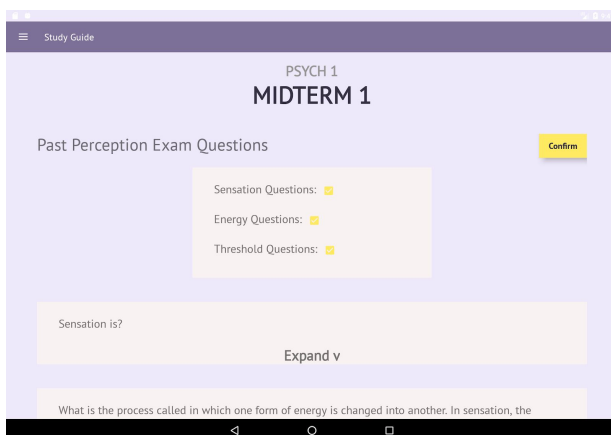
Click on "Expand" for Unit 2



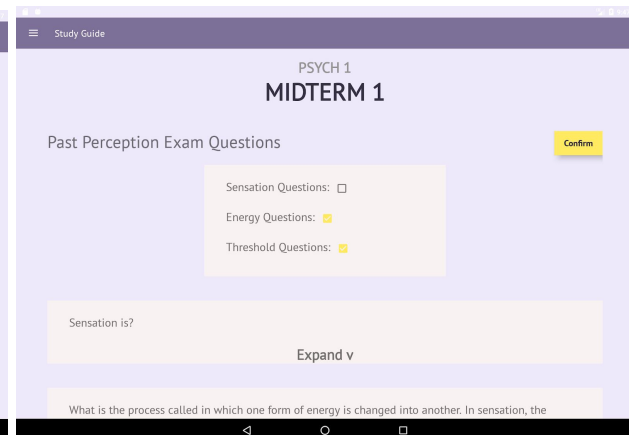
Scroll and click on "View" for "Past Exam Questions"



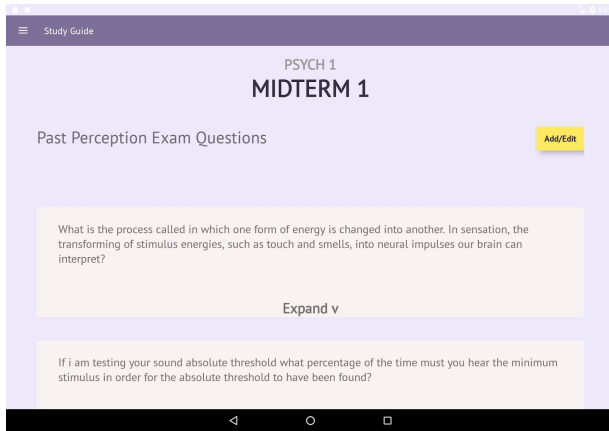
Click on "Add/Edit" to personalize



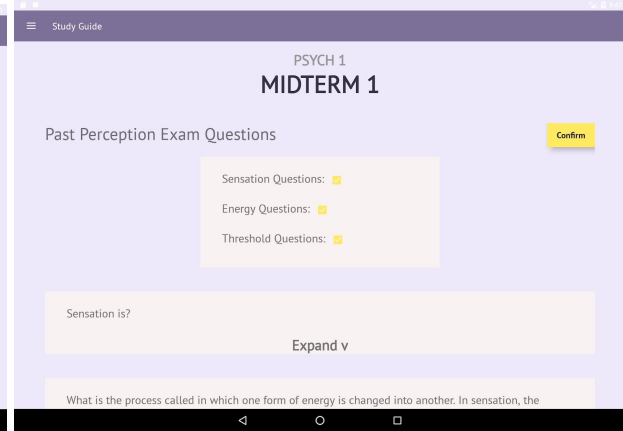
Click on the checkbox next to "Sensation Questions"



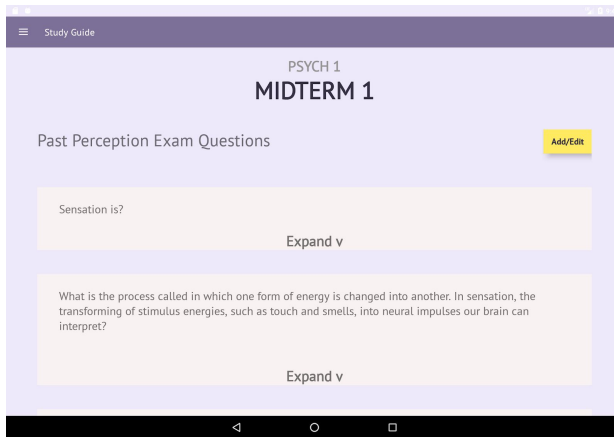
Click "Confirm"



The Sensation question that was at the top of the page is now removed. Click "Add/Edit" to add it back.



Click on the checkbox next to "Sensation Questions" and then "Confirm"

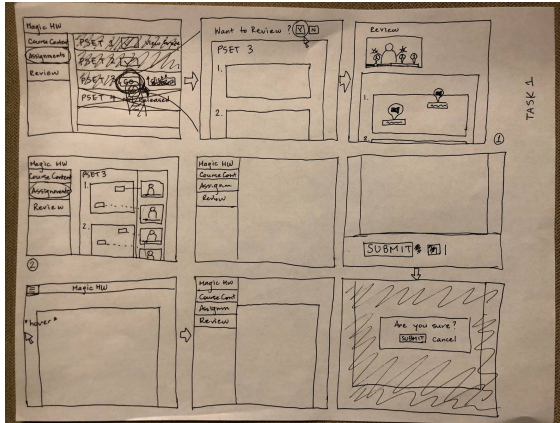


The sensation question reappears again

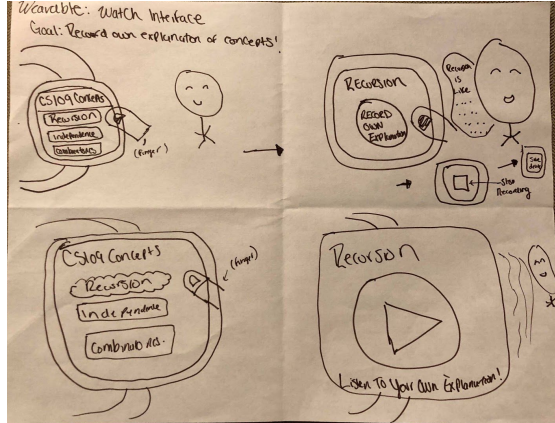
Design Evolution

Initial Sketches

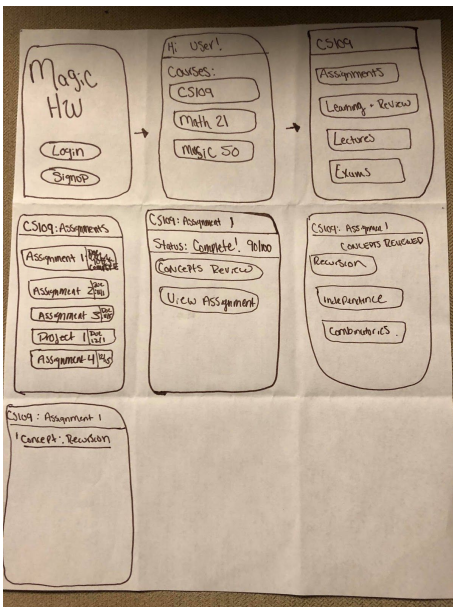
First, we brainstormed multiple realizations of our application across different devices and a wide variety of input/output modalities.



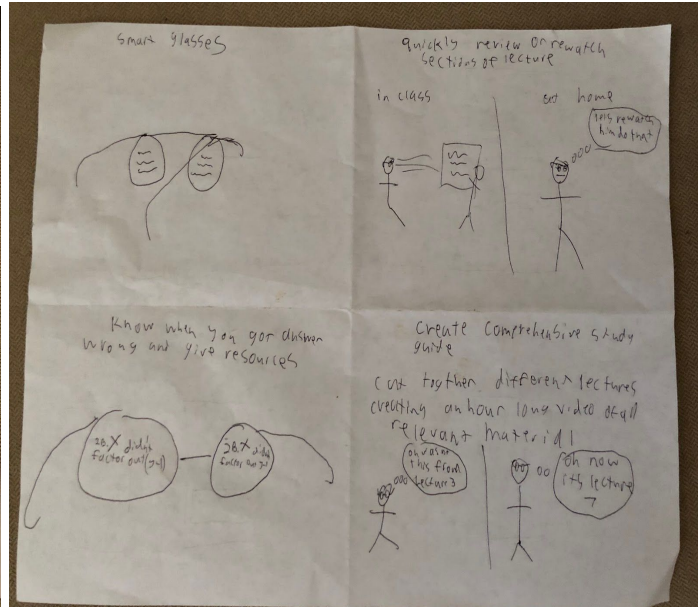
Web interface



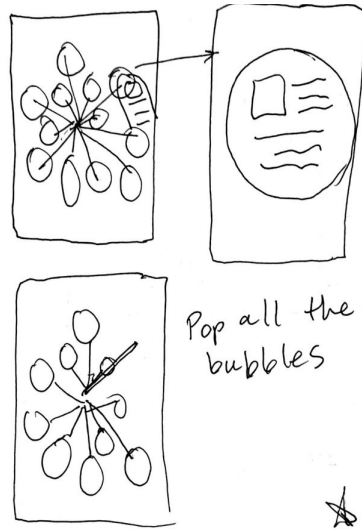
Wearable interface



Native Phone menu interface

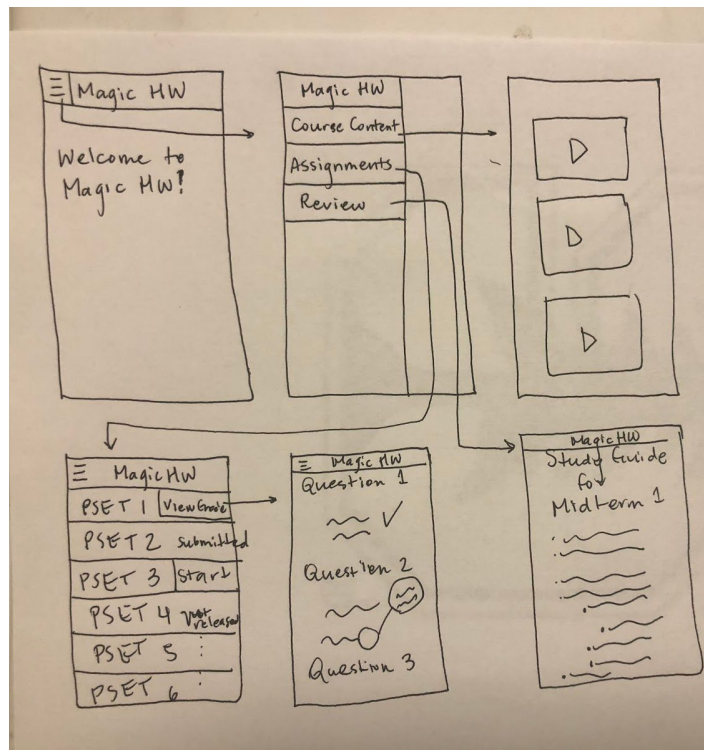


AR interface



Bubble pop phone interface

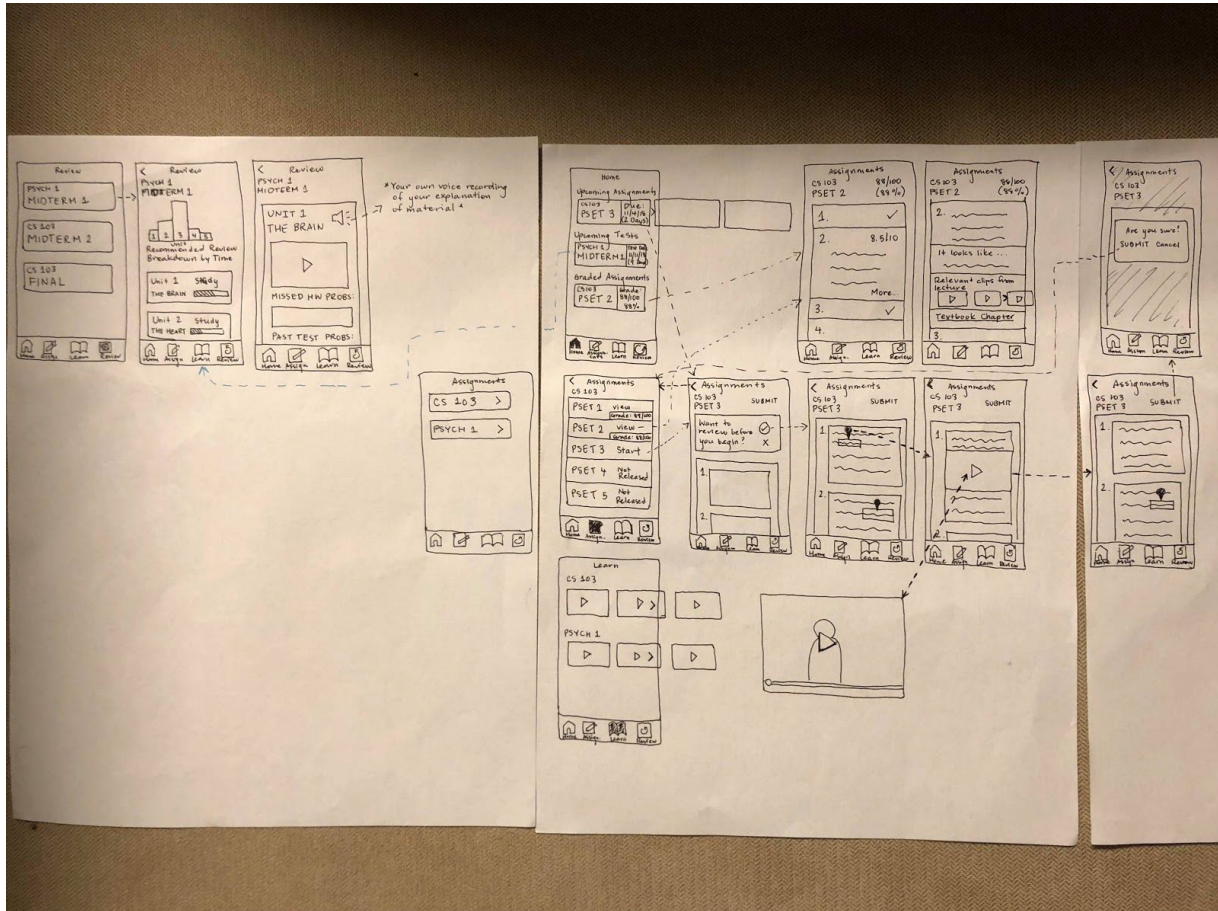
At the end of this exercise, combined the design of the web app and the native phone interface to create a native phone interface with a side menu, in which students can access Course Content, look through Assignments, and Review for an exam. We chose this interface because it allowed for easy navigation, it would be good for visual learners and it would have potential for widespread use since many students have phone already.



Native phone side menu interface

Low-Fi Prototype

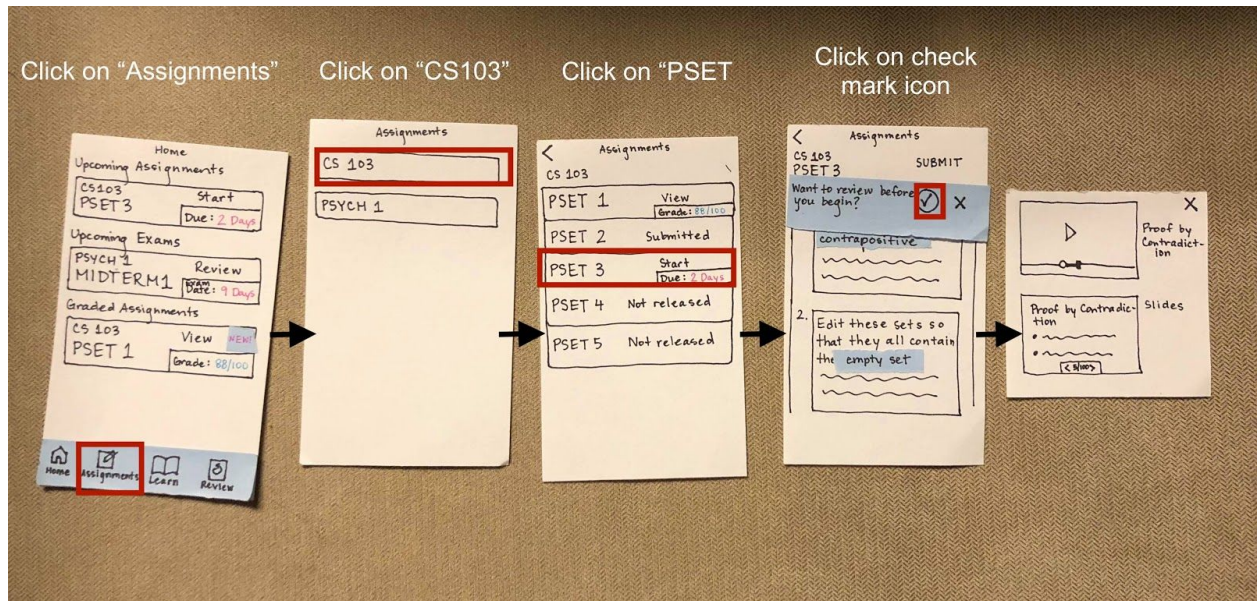
The full storyboard of the interface chosen from the previous step can be seen below:



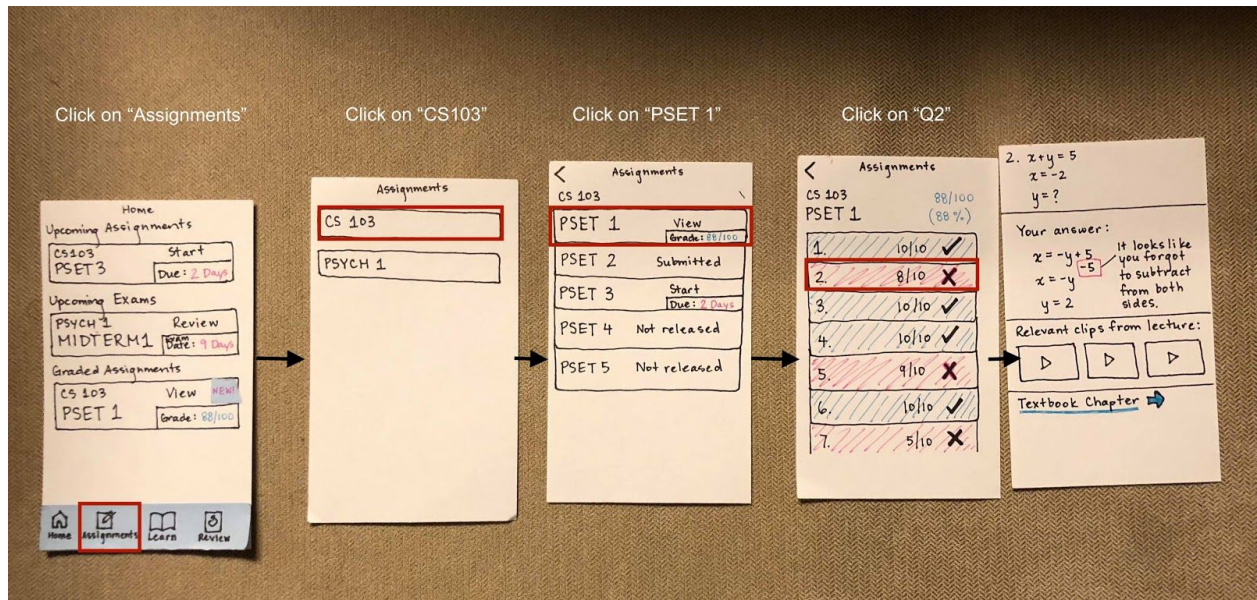
Full storyboard

The task flows for each task on our prototype can be seen below:

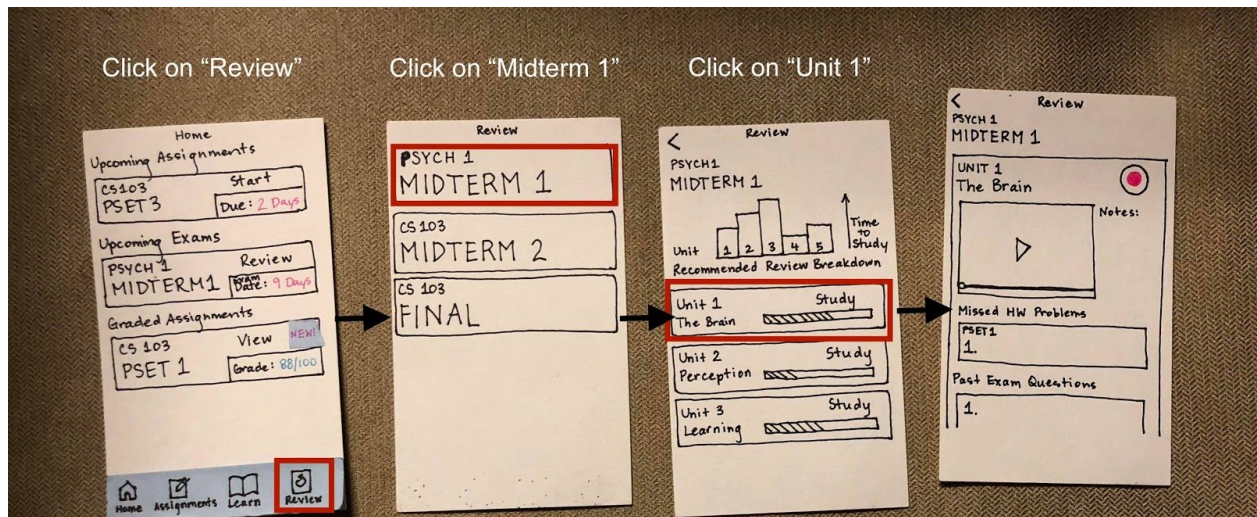
Simple - Find content relevant to an assignment



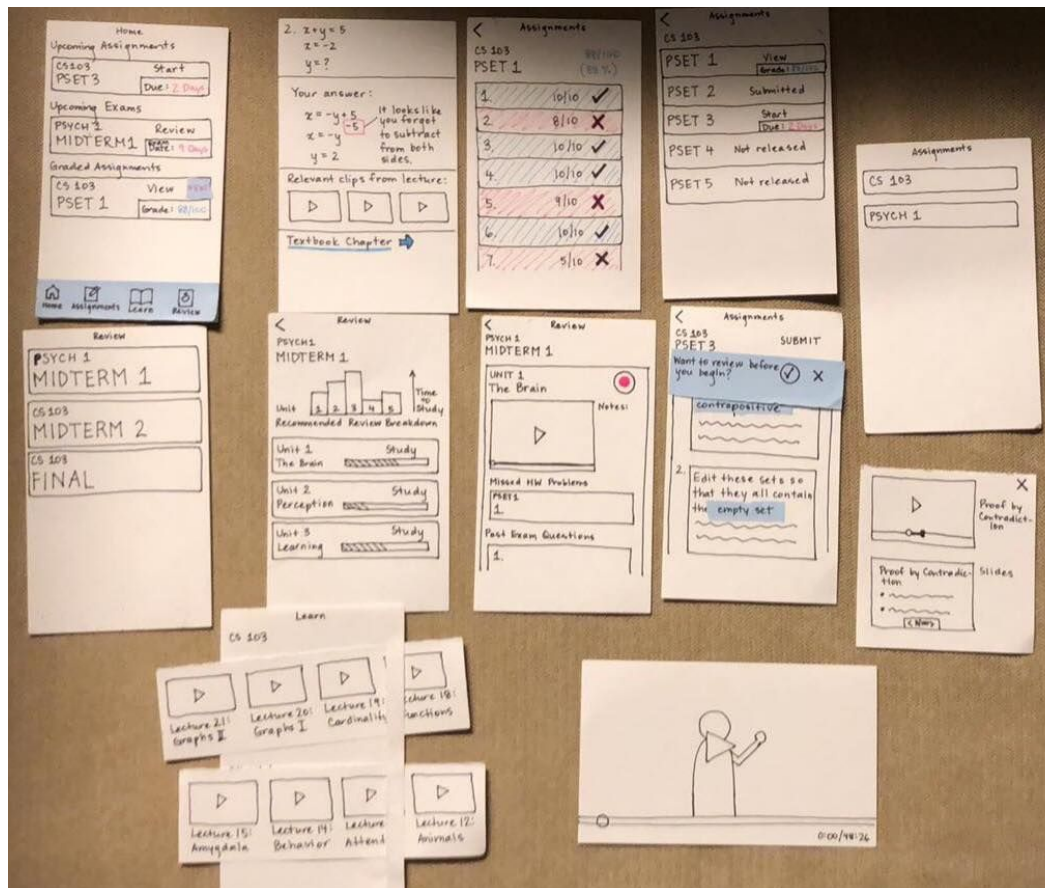
Moderate - Review questions that the user had gotten wrong in previous assignments



Complex - Review relevant material for an upcoming exam



All Screens



Medium-Fi Prototype

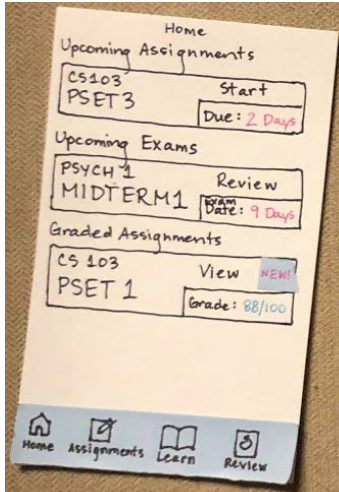
Updated tasks

We got feedback that all our tasks felt very similar, both in the functionality that they provided as well as the task flows that were implemented for each. We modified our tasks to take this feedback into account. The updated tasks were:

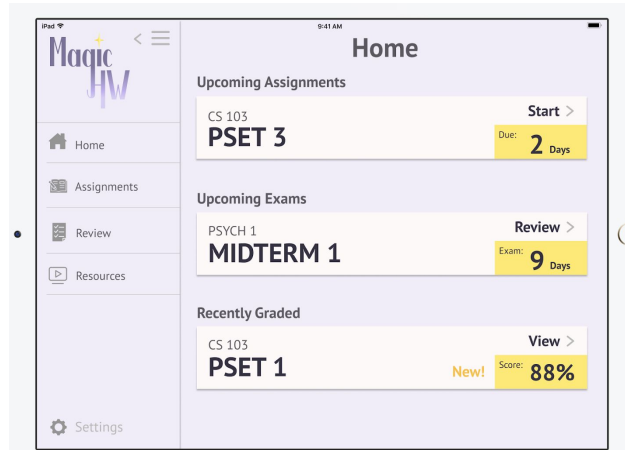
- **Simple**
You can use MagicHW to look at an upcoming pset, and easily get access to relevant material
- **Moderate**
OLD: You can receive personalized feedback on graded pset.
NEW: When you get a question wrong you can connect with someone who got it right.
- **Complex**
OLD: You can receive a review sheet comprised of past missed problems and problems from previous exams
NEW: You can create a custom review sheet that covers multiple units with recommendations from our AI

Major Design Changes

- **Mobile to Tablet**
Our biggest change between the low-fi sketches and the new sketches was moving from a mobile application to a tablet application. We modified all the design elements to adapt to a tablet interface (eg: menu on the side, as opposed to on the top, bigger menu items)
Rationale- The tablet application has more screen space which provides a better interface for a homework application. Students are more likely to do their homework on a tablet, as opposed to on their phone.



Before

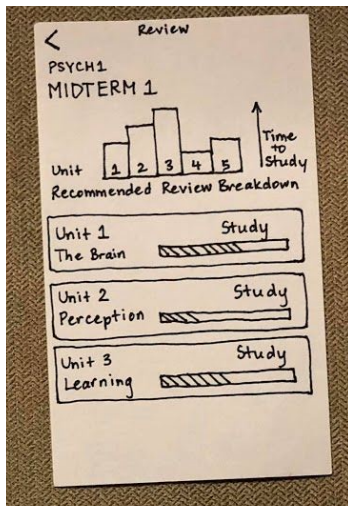


After

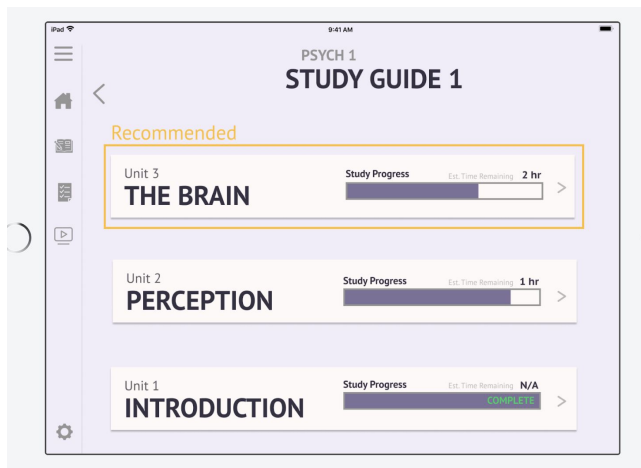
- **Simplified Analytics**

We switched from complex analytics showing time taken to study a topic, recommended review breakdown, progress, importance on midterm etc to a simple interface that sorts units as “recommended”.

Rationale - Through all our interviews, we got the feedback that the analytics we presented were very confusing and hard to interpret. They did not help the students in any decisions about which modules to pick.



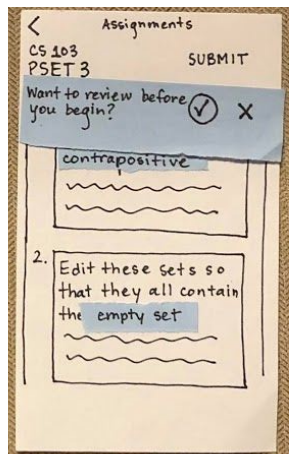
Before



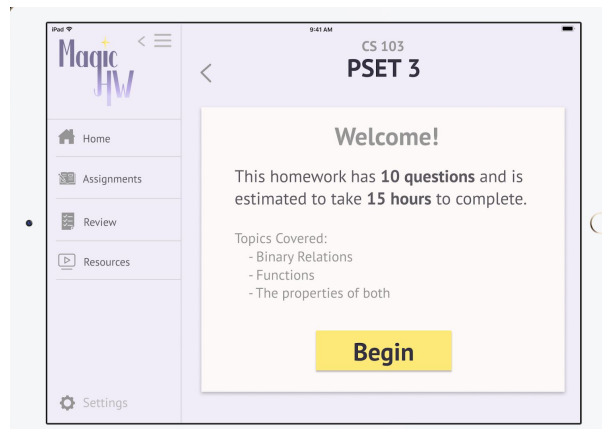
After

- **Previews/ Time taken**

Another recurring feedback that we got from our users was it was hard to know what problem/PSET they should start working on (given their time constraints). The app interface also provided no knowledge about a problem/PSET before it's clicked on. To remedy these issues, we added "Estimated time taken" to each problem/PSET as well as each midterm review unit. In addition, we added short snippets of text describing the content of each PSET/ problem, along with useful information such as number of points for each question.



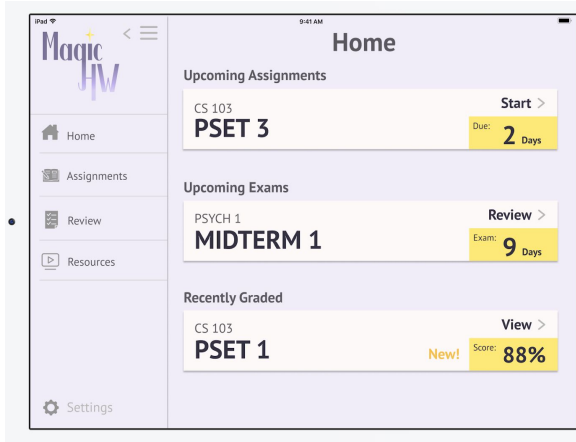
Before



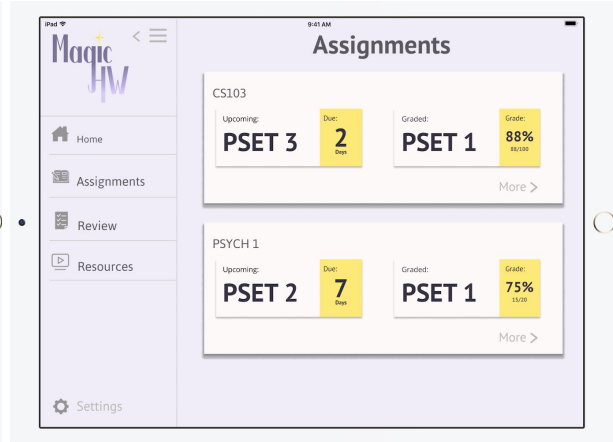
After

The task flows for each of our new task on our medium-fi prototype can be seen below:

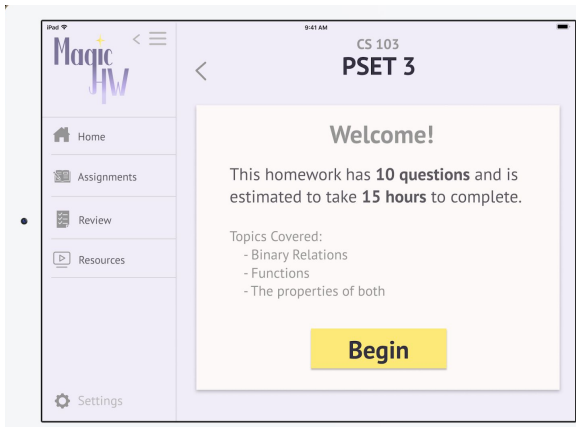
Simple: Access material relevant to upcoming PSET



Click on "Assignments"



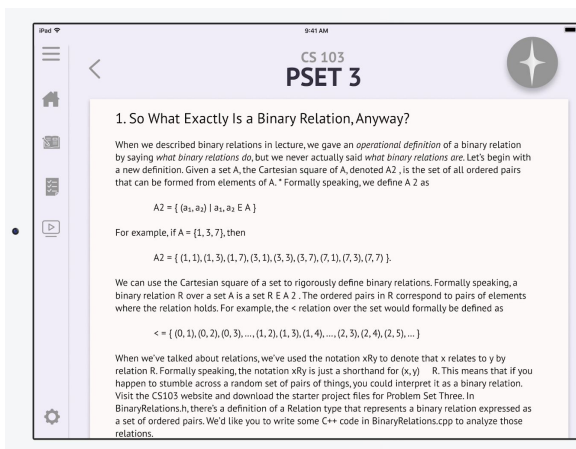
Click on "PSET 3"



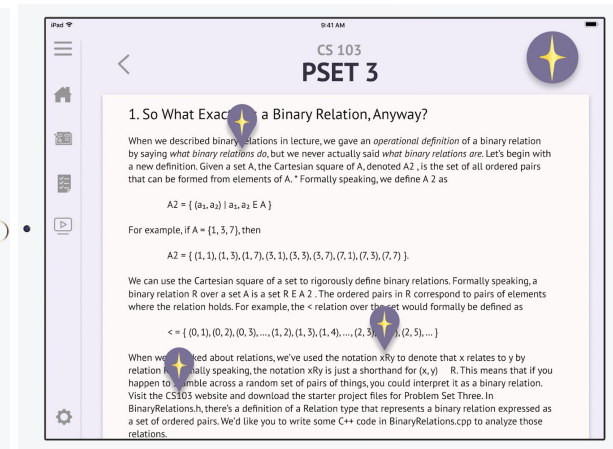
Click on "Begin"



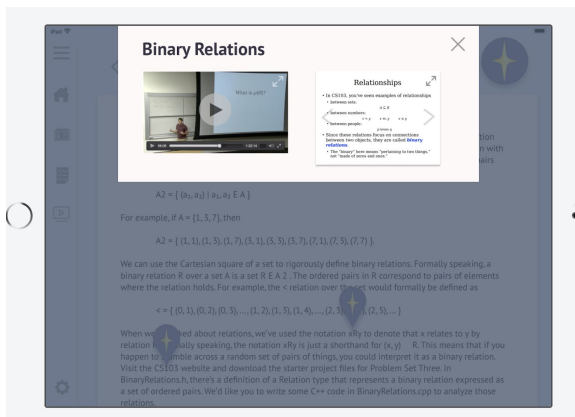
Click on "Expand"



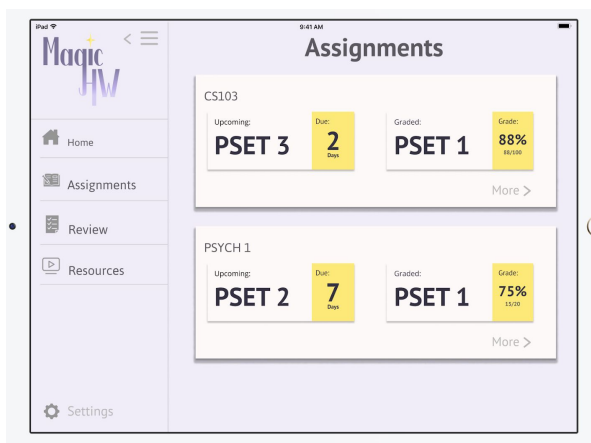
Click on grey button at top



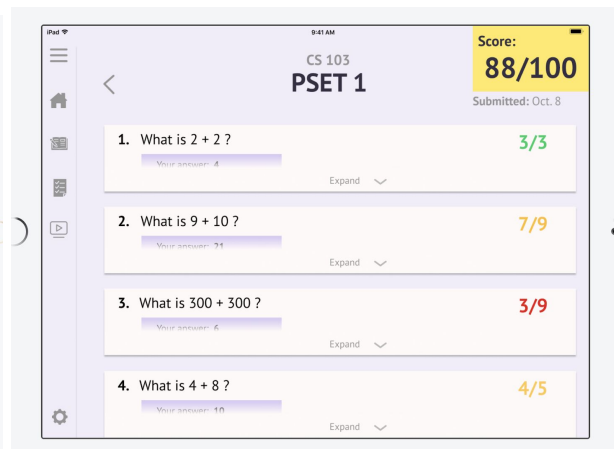
Click on first pin



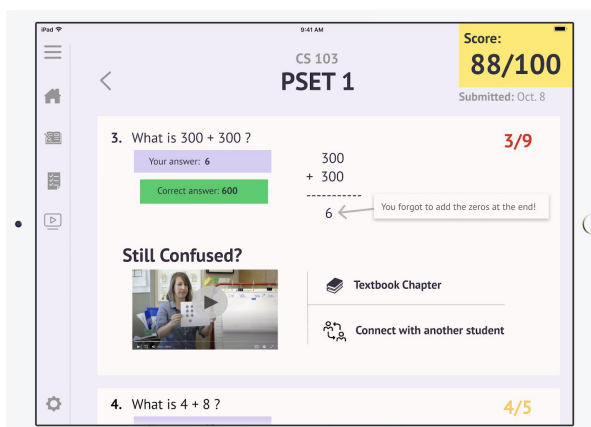
Moderate: Get feedback when you get a problem wrong and connect with a student



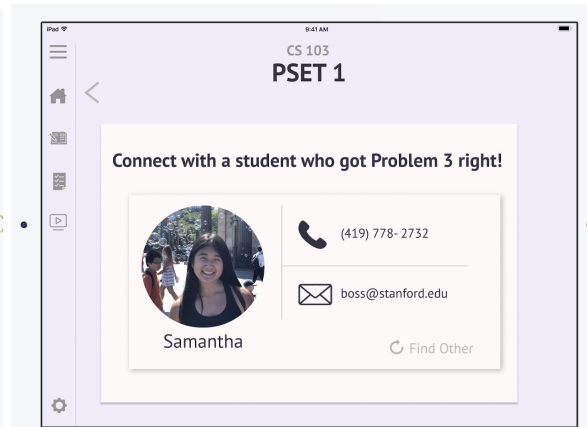
Click on "PSET 1"



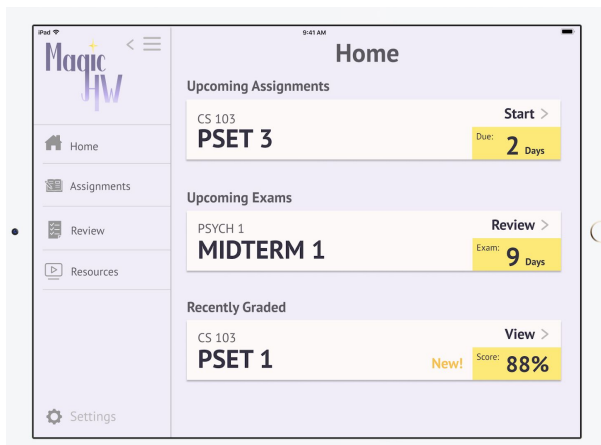
Click on "Expand" for Q3



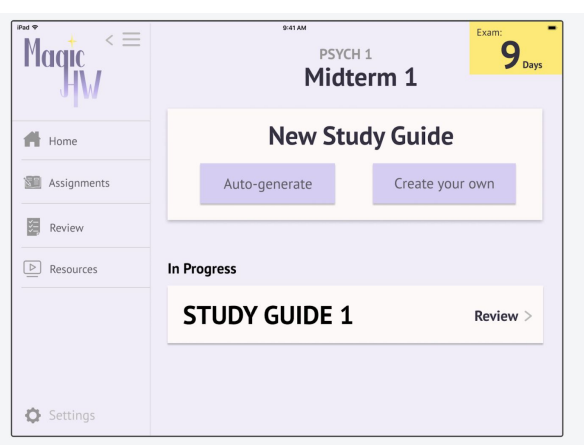
Click on "Connect with Another Student"



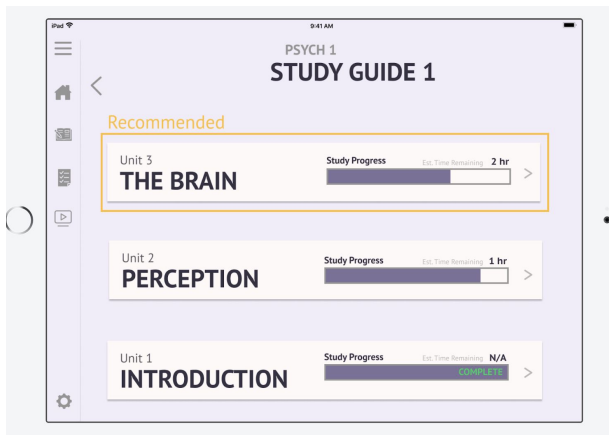
Complex : Create a custom review sheet



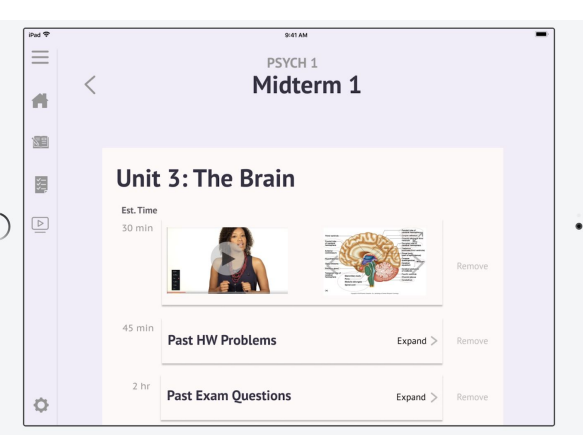
Click on "Review" for Midterm 1



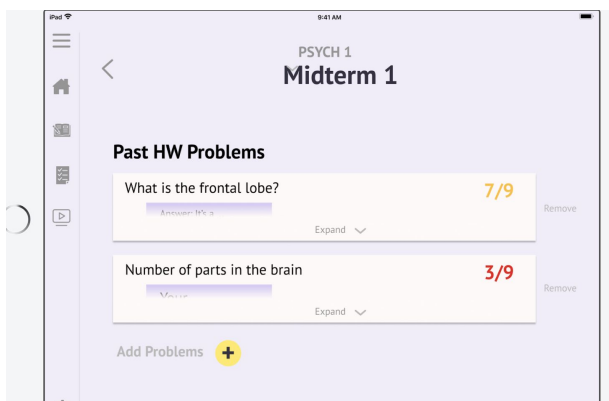
Click on "Review" next to "Study Guide 1"



Click on "Unit 3"



Click on "Expand" next to "Past HW problems"



Final Design

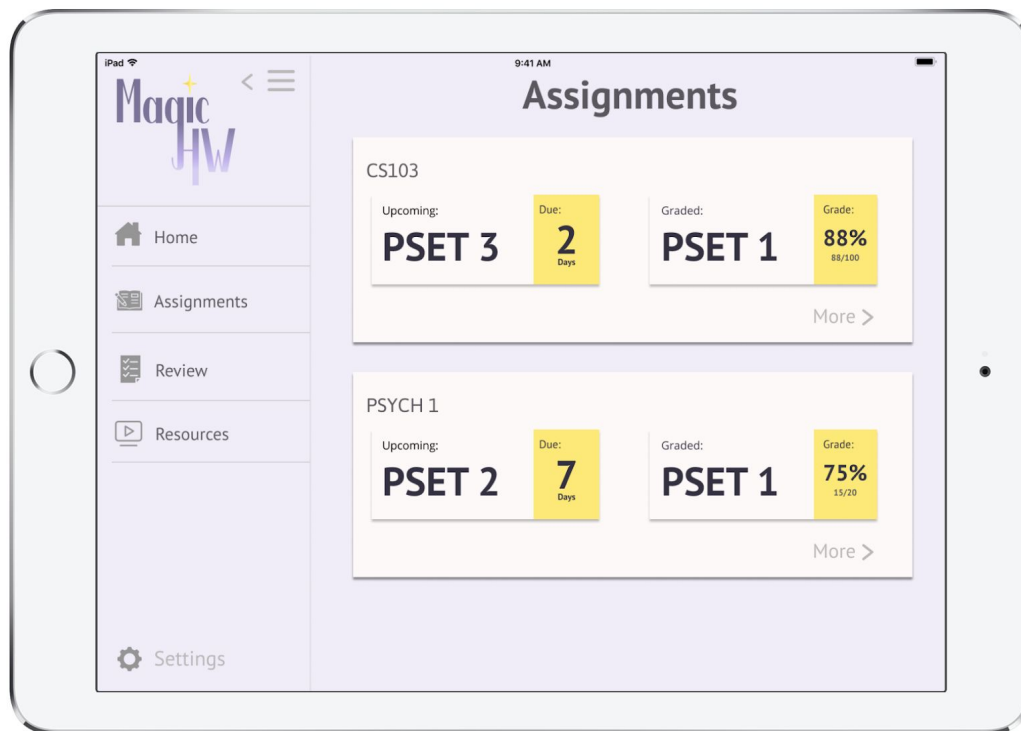
After incorporating the feedback from the heuristic evaluation tests (discussed in the section below), we implemented our final design in Android Studio. The final design and task flows are described in the section “Tasks and Final Interface Scenarios”.

Major Usability Problems Addressed

Level 3: Sidebar is always visible; it should be able to be opened and closed.

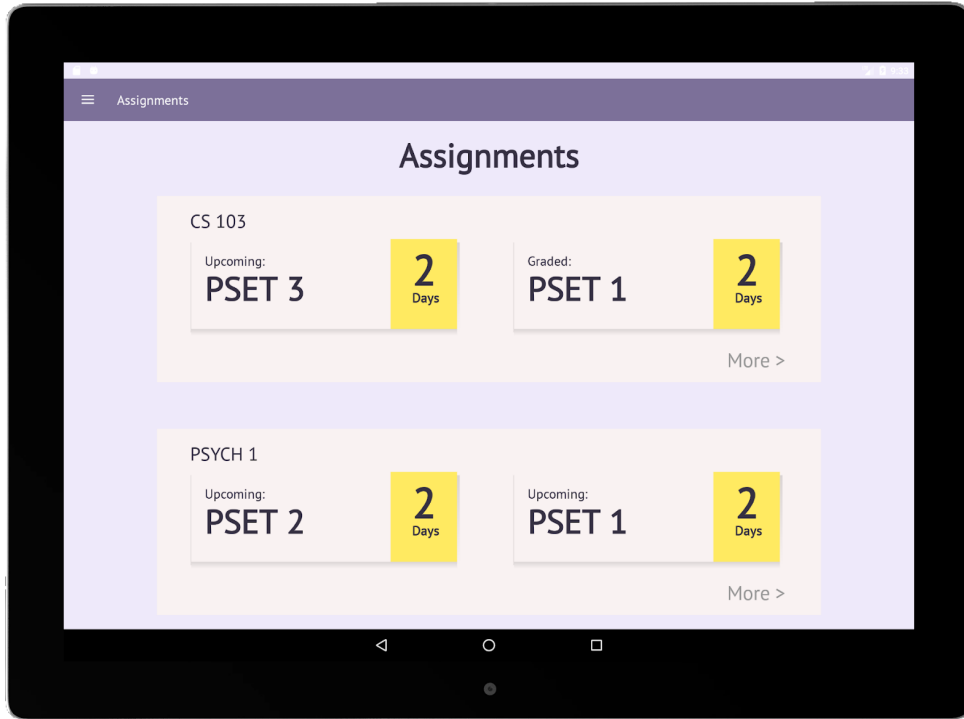
This was mainly a limitation associated with the tool we used for our medium-fi prototype- Marvel, and we have a fully functioning opening and closing side drawer navigation bar in our hi-fi prototype.

Med-Fi

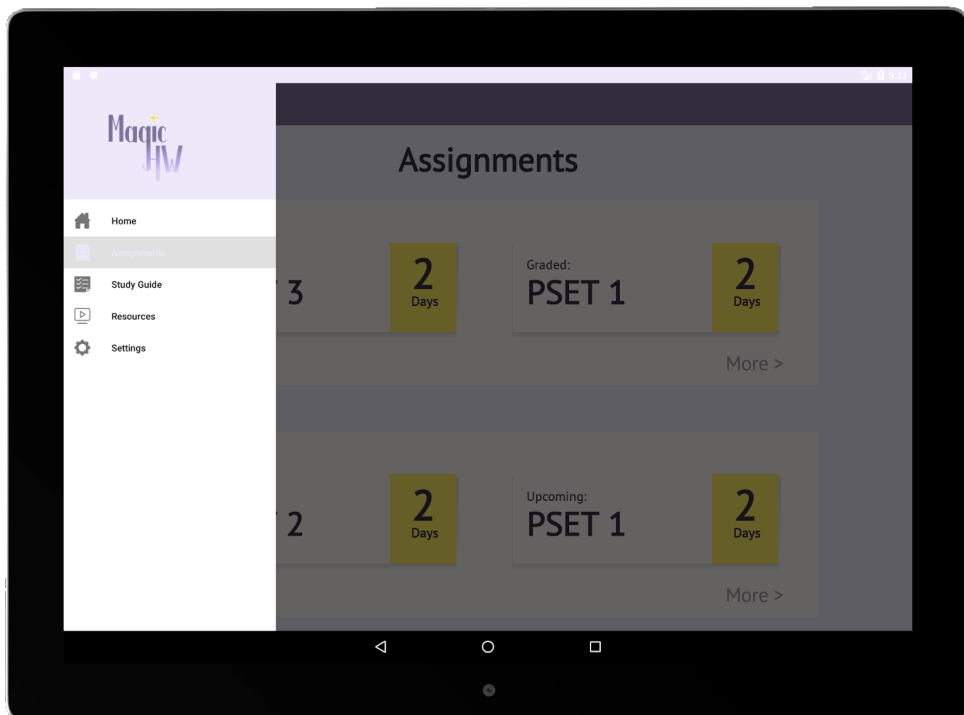


Sidebar always open

Hi-Fi



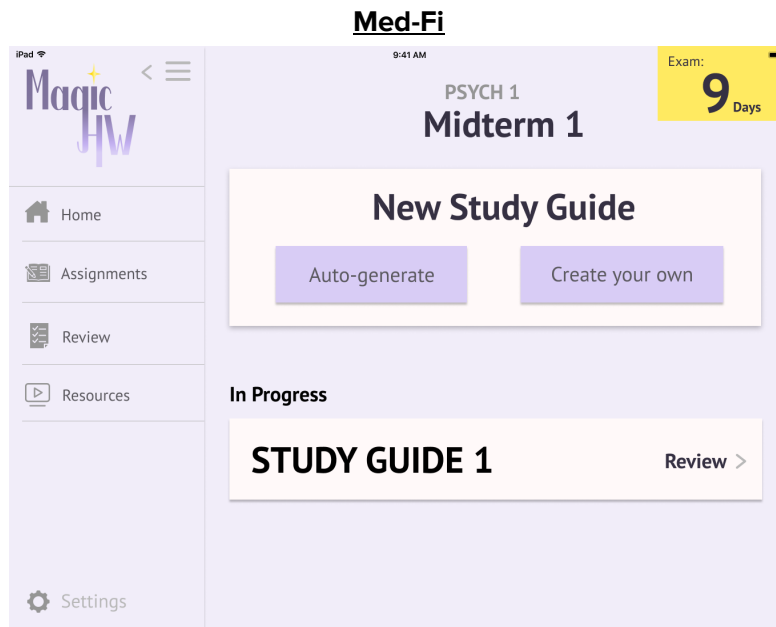
Sidebar closed



Sidebar open

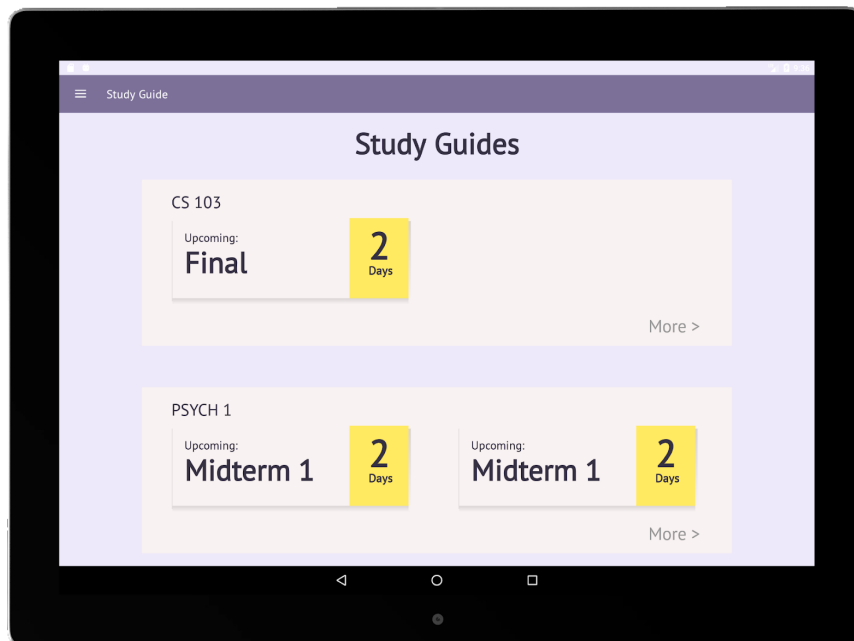
Level 3: Review tab doesn't group the classes in the way that the Assignments tab does.

This was an oversight in our medium-fi prototype, and we added an additional class-organized page. We also changed the name of the Review tab to Study Guide to be clearer to the purpose of the tab.



Review landing tab

Hi-Fi

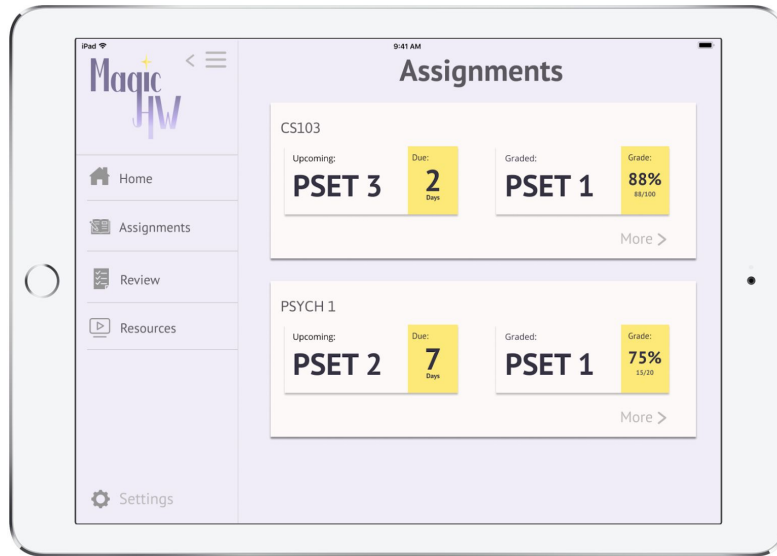


Study Guides landing tab

Level 4: The app should have a tab called Classes, with a section for assignments and a section for review, like Canvas.

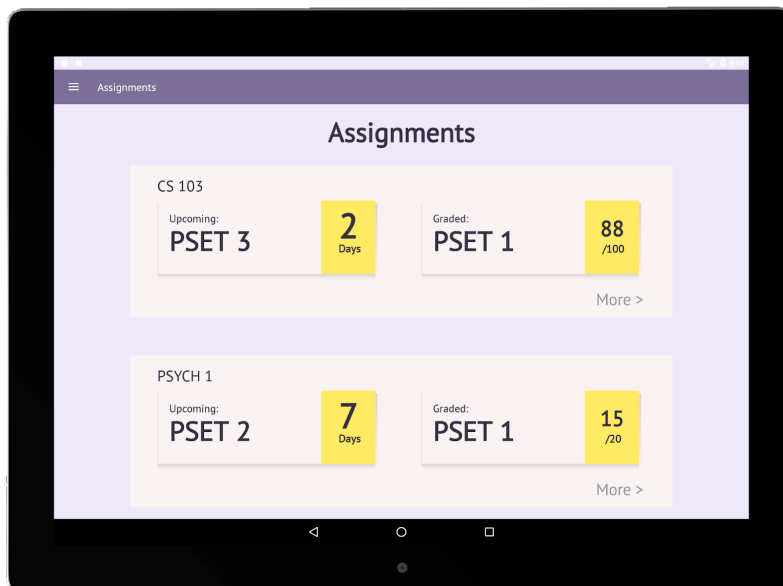
We decided not to implement this suggestion as part of our goal of MagicHW was to make the experience efficient and relevant to the students. We were frustrated with the class structure of Canvas and Gradescope, as it requires many steps to get to the relevant information: the assignments and exams. The purpose of our Assignments and Review tabs is to get the students the information they need easily.

Med-Fi



Assignments tab

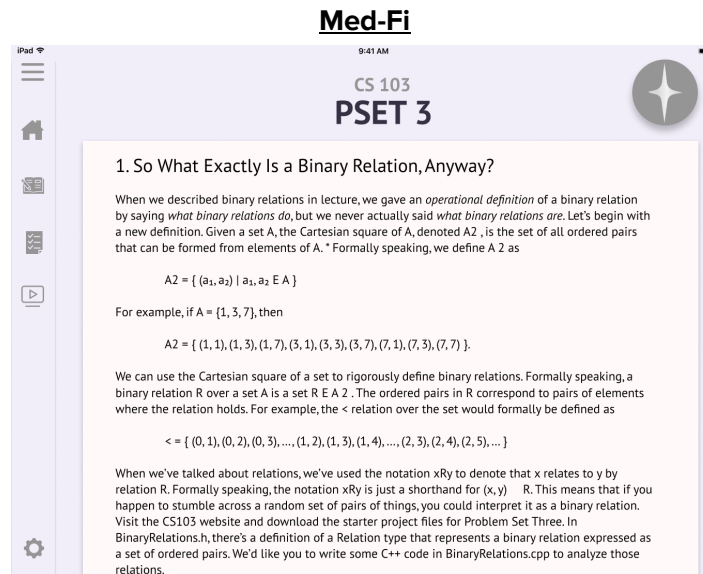
Hi-Fi



Assignments tab (Unchanged)

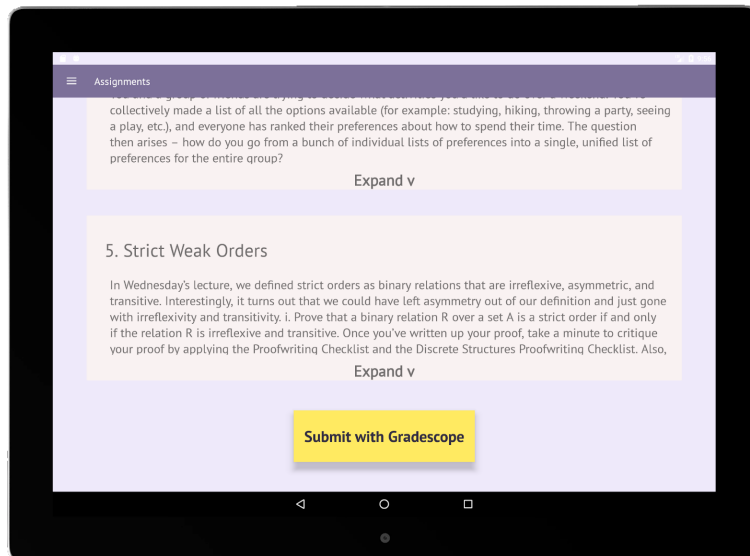
Level 4: It's unclear if the student completes and submits their homework assignments with the app.

We decided that it would make more sense in terms of merging with current class designs to interface with Gradescope instead of submitting through MagicHW. We removed the time estimates and added messages such as "Submitted through Gradescope". We also added a button at the bottom of the PSET 3 page that states "Submit through Gradescope" that links to the website.



No submit button

Hi-Fi



Submit with Gradescope added

Med-Fi

CS 103
PSET 1

Score: **88/100**
Submitted: Oct. 8

1. What is $2 + 2$? **3/3**
Your answer: 4 Expand
2. What is $9 + 10$? **7/9**
Your answer: 21 Expand
3. What is $300 + 300$? **3/9**
Your answer: 6 Expand
3. What is $4 + 8$? **4/5**
Your answer: 10 Expand

Appears to have been submitted through the app

Hi-Fi

Assignments

CS 103
PSET 1
On Gradescope

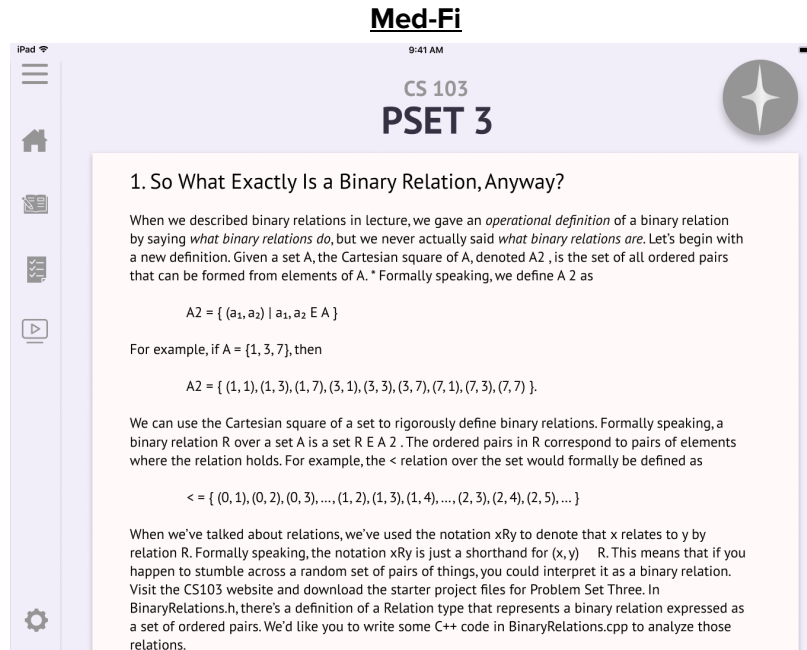
Score: **88/100**

1. What is $2 + 2$? **20/20**
Your answer: 4 Expand v
2. What is $300 + 300$? **10/20**
Your answer: 6 Expand v
3. What is $10 + 9$? **18/20**
Your answer: 21

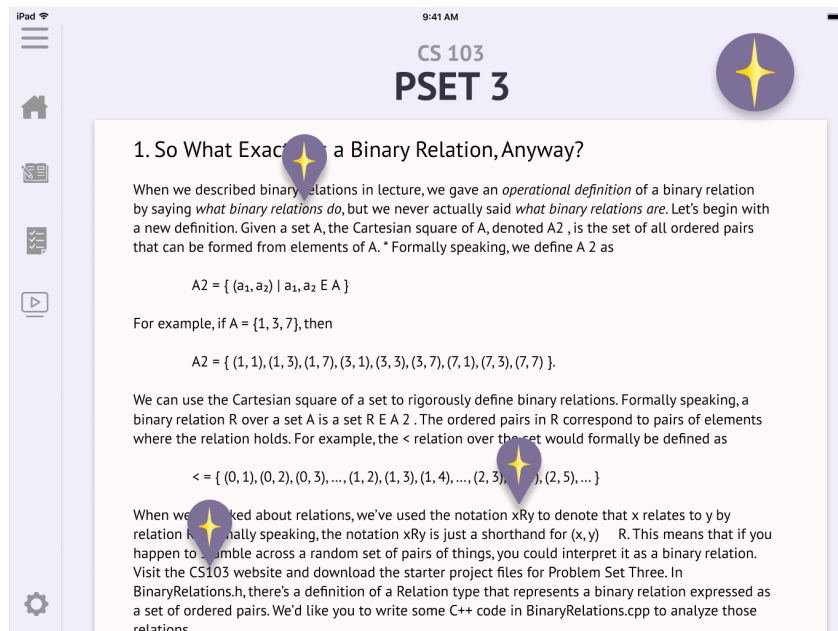
Submitted "On Gradescope"

Level 3: The Magic Help button looks unclickable.

Rather than relying on iconography that is likely not familiar to first-time users, we decided to simplify the representation of the button and have text reading “Turn Help On” and “Turn Help Off”. This button is initially yellow so that it appears clickable, then once the button is clicked and help is on, it turns to grey. In addition, the magic help popup icons obstructed the text, so we changed those to clickable highlights in the text.

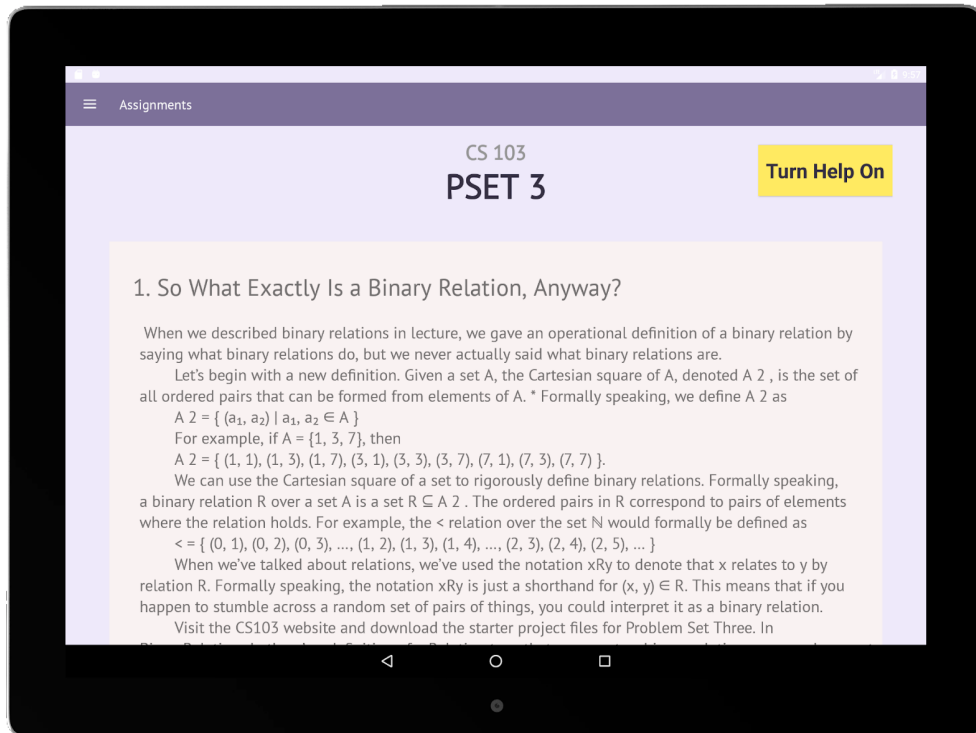


Help Off

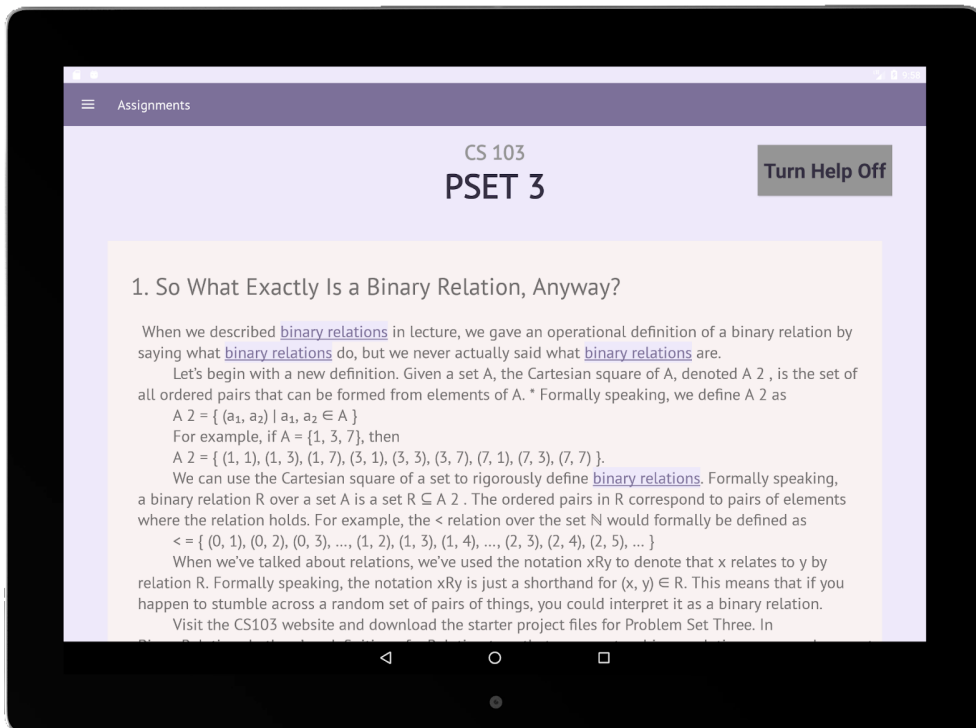


Help On

Hi-Fi



Help Off

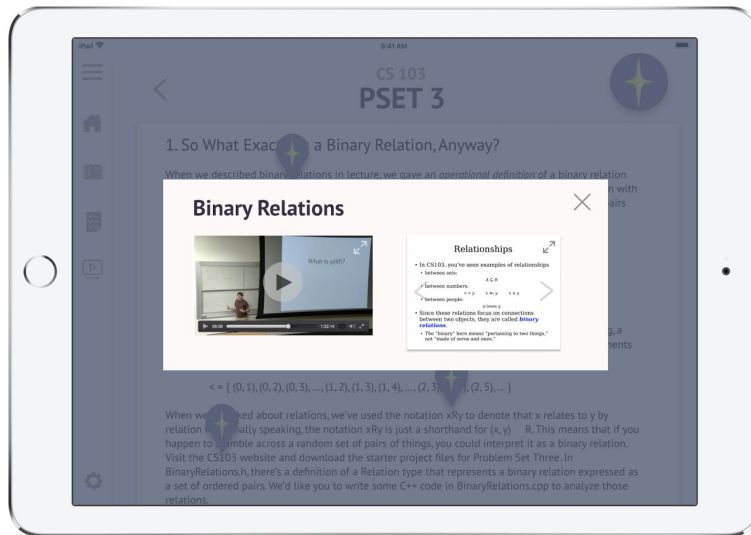


Help On

Level 3: There's no place to mark if the resources that come up when the Magic Help button is clicked are actually correct and useful.

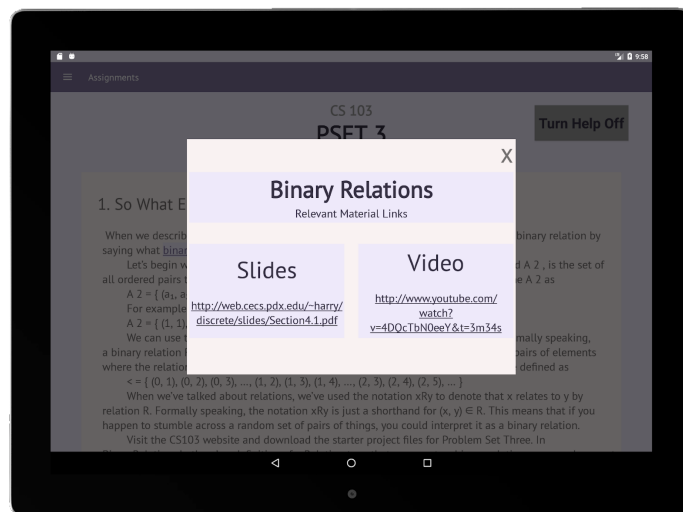
We felt that this was more of a feature that would be nice to have than was necessary to achieve our tasks. Furthermore, since we have not actually implemented the AI algorithms, this additional information was not integral for the function of the app. Thus, we did not add this to our resources popup. As an aside, due to our skill limitations in Android Studio, we were not able to embed the videos and slides as shown in our medium-fi prototype, but our video link does send users to a Youtube video at the moment when binary relations are taught.

Med-fi



Help popup screen

Hi-Fi

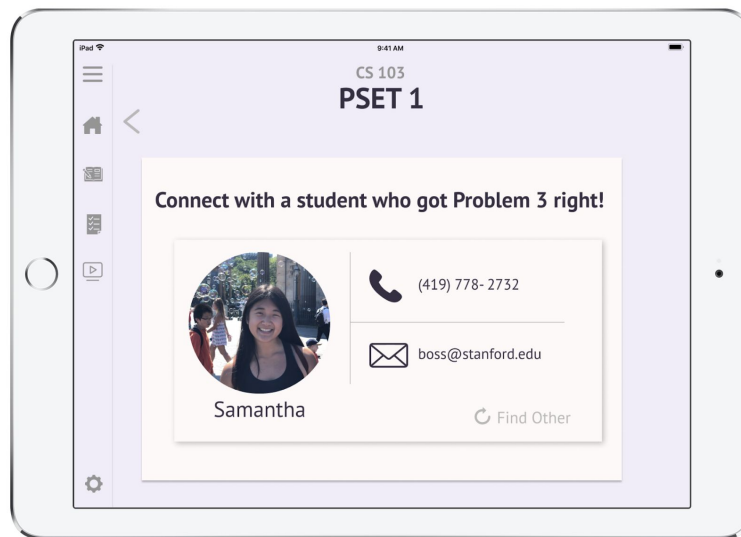


Help popup screen

Level 3: Giving all the students other students' phone numbers is a privacy concern and puts the effort onto the student to reach out and ask for help personally.

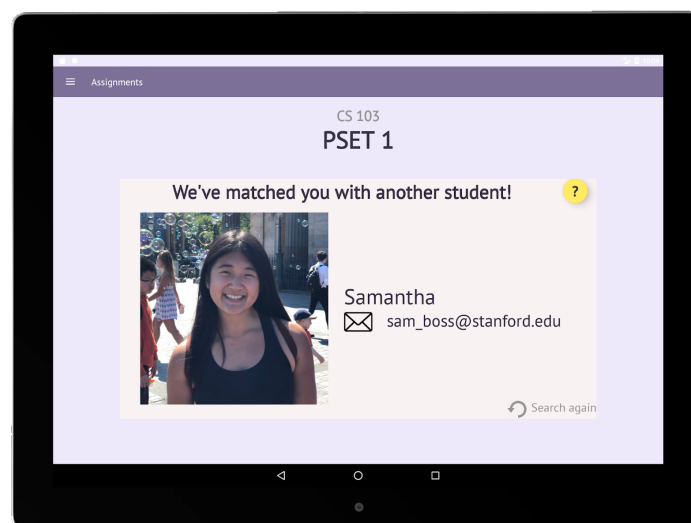
We agreed that this could be a privacy concern, so we removed the phone numbers from the contact screen. Implementing an in-app messaging system (as was suggested in the heuristic evaluation) was a bit more complicated than we had time to complete and was not a major focus of our task, so we only gave the students' email addresses. We also changed the wording of the screen and added a Help ("?) button that explained our matching algorithm so students have more insight as to how they are matched, since the previous matches seemed very one-sided. Now, it's much clearer that the relationship between the students is reciprocal.

Med-fi

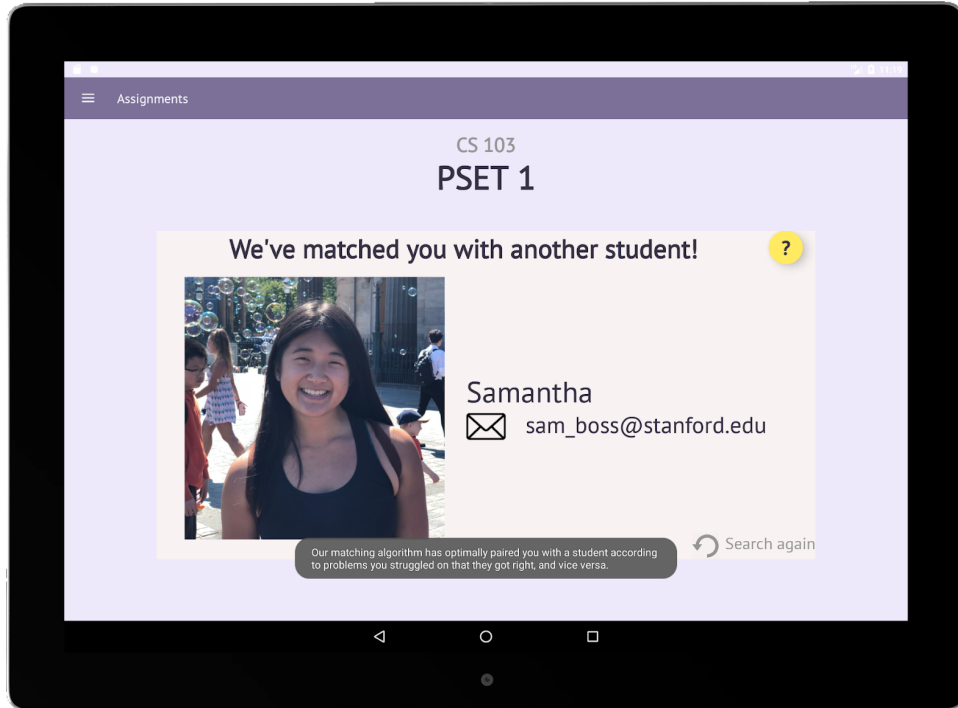


Contact screen with phone number and email

Hi-fi



Contact screen with email only

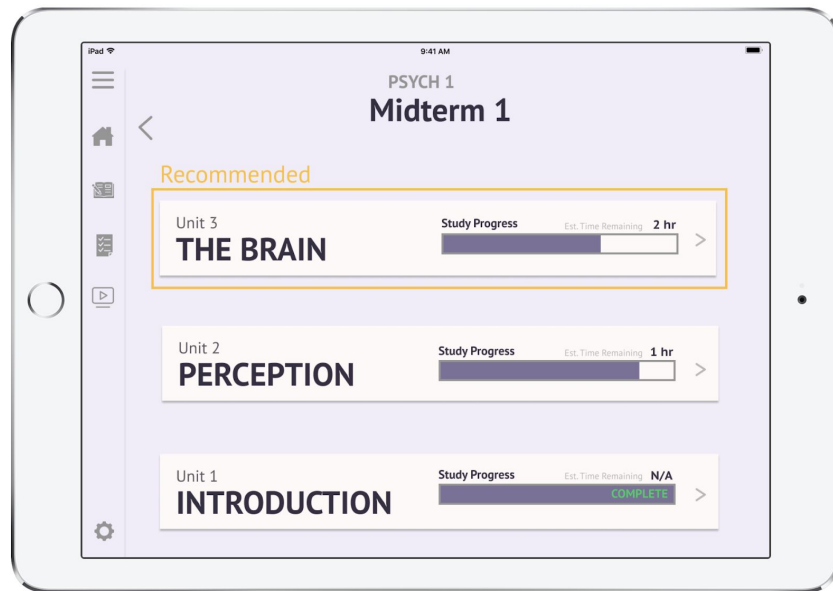


Contact screen with help message

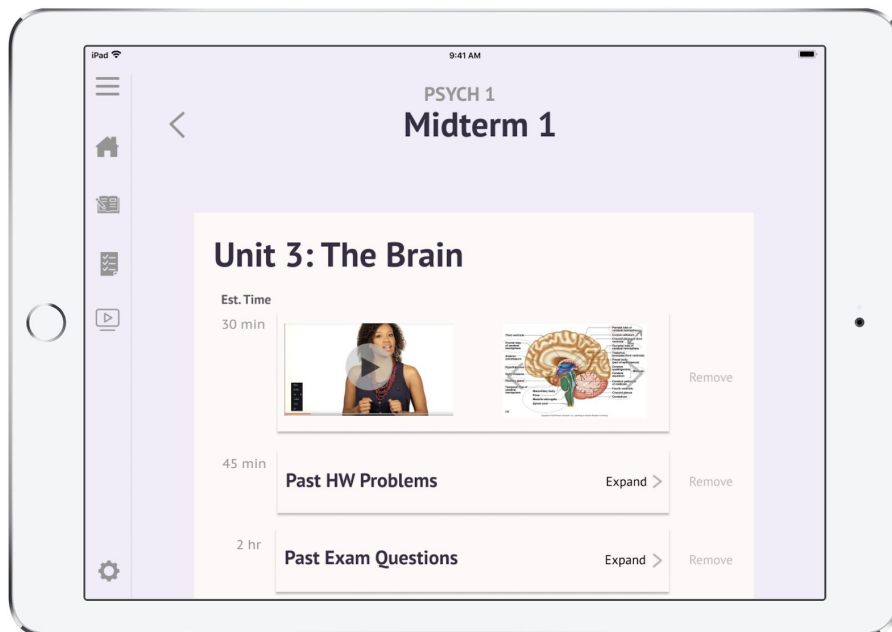
Level 3: The user can remove sections from their study guide but can't add new ones or add back sections they may have accidentally deleted.

We changed the structure from our medium-fi prototype to our hi-fi prototype so that all of the possible sections are available on the review sheet, but the user can hide certain sections as they please. This gives the users the flexibility to hide the sections that they feel confident about.

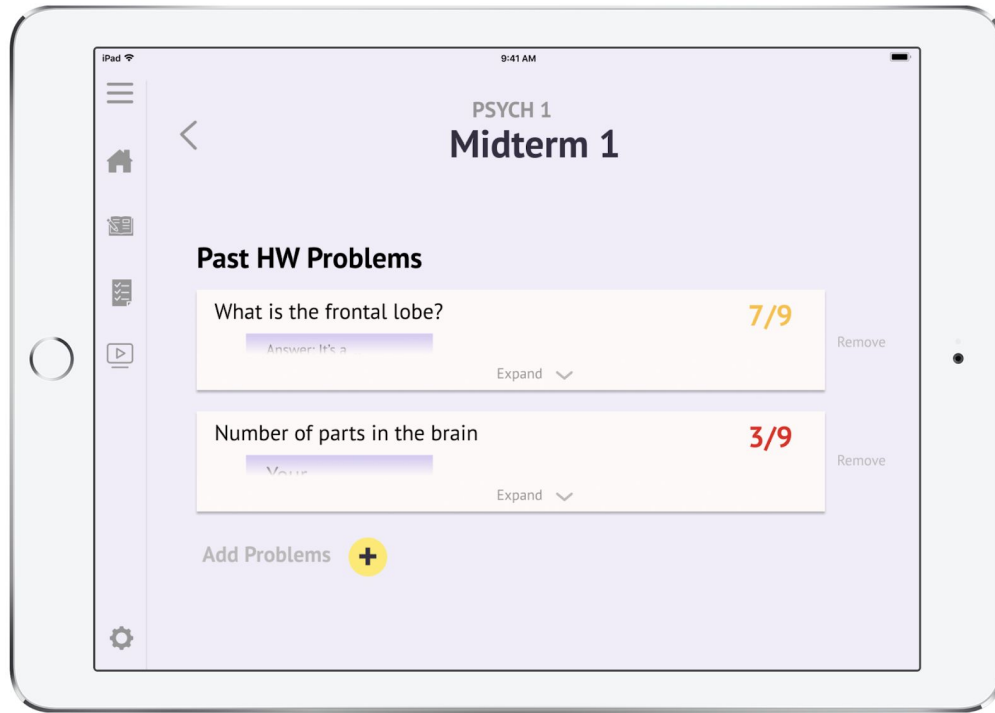
Med-Fi



Recommended tab,, no explanation

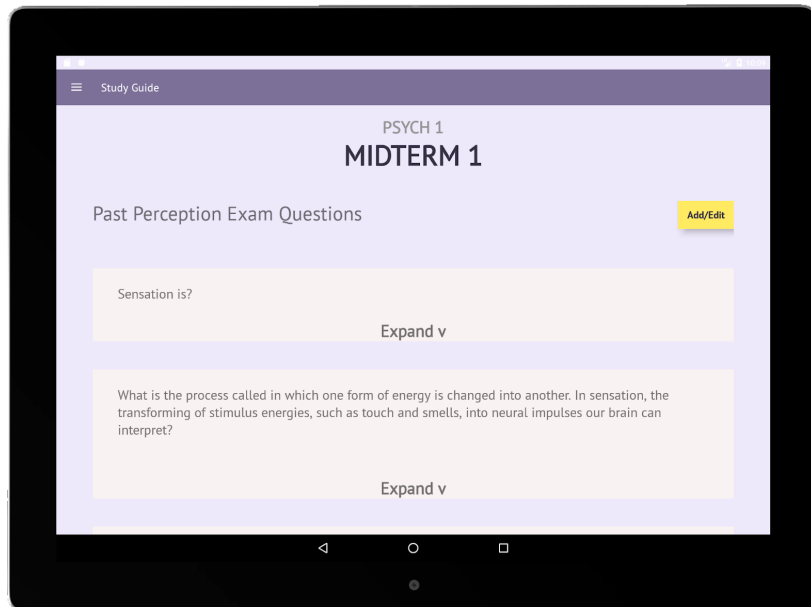


Psych 1 Study Guide

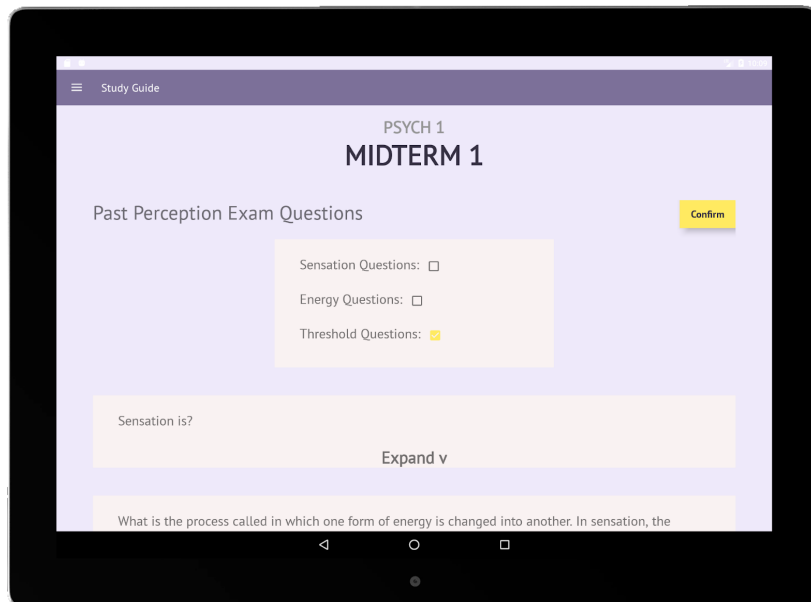


Past Psych 1 HW Problems

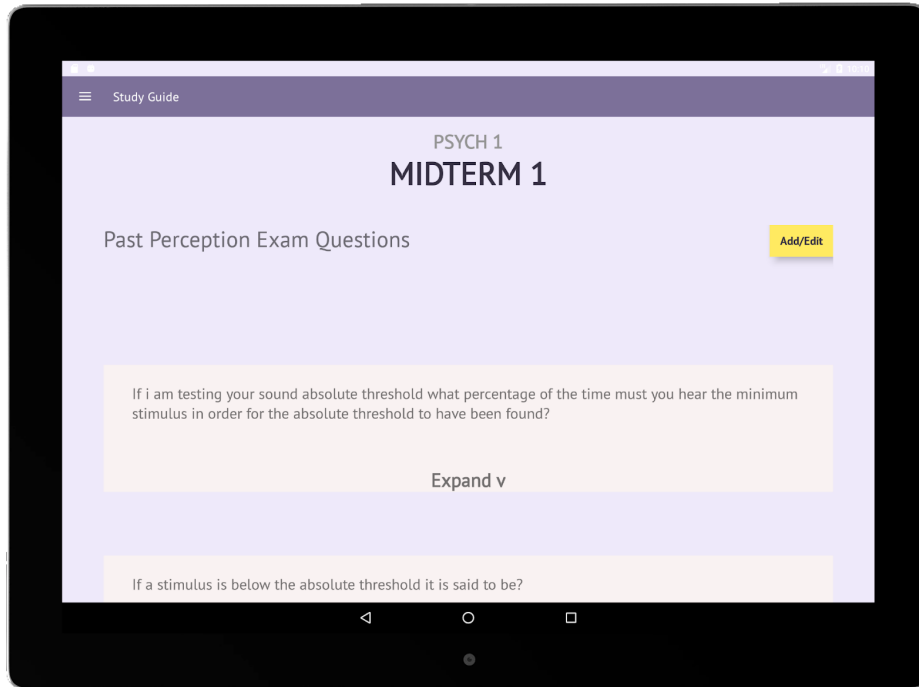
Hi-Fi



Psych 1 Study Guide



Hiding Sections

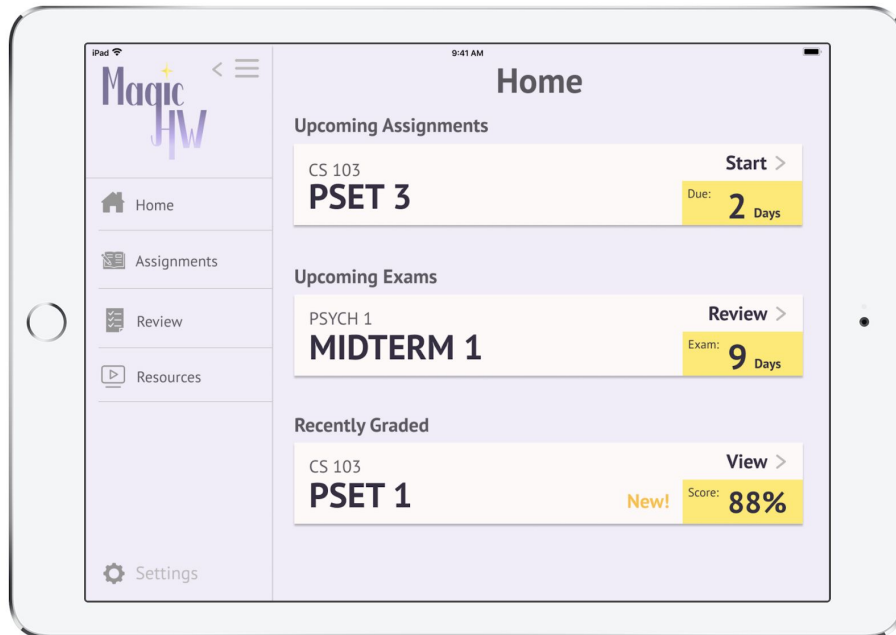


Psych 1 Study Guide (Sections Hidden)

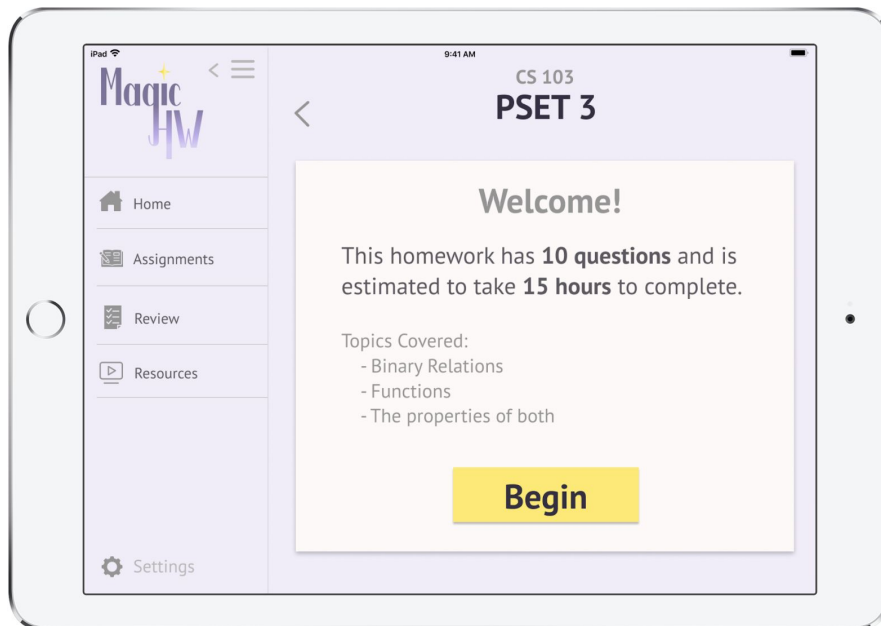
Level 4: Clicking PSET 3 from the Home page and then the back button brings the user to assignments, not the home page.

This also was a limitation of Marvel. In our hi-fi prototype, we use the functionality of the back button on the Android tablet to control this navigation, and it works on a history stack similar to web browsing. This makes the navigation experience more intuitive for the user.

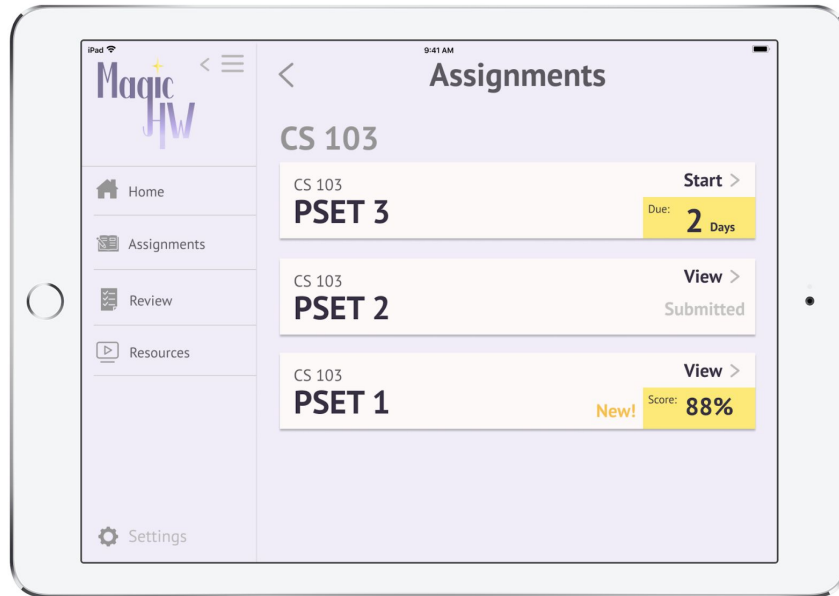
Med-Fi



Home Screen, click PSET 3

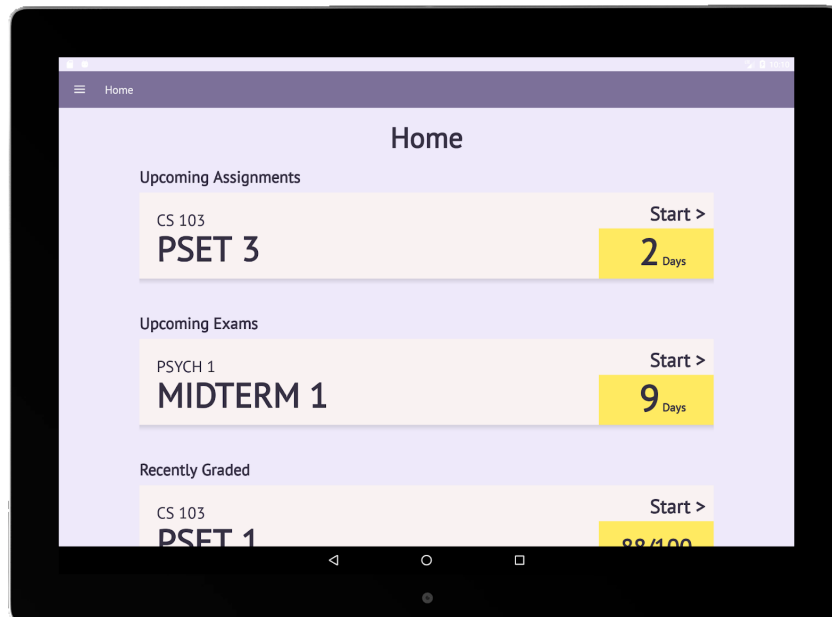


PSET 3 Welcome page, click back button

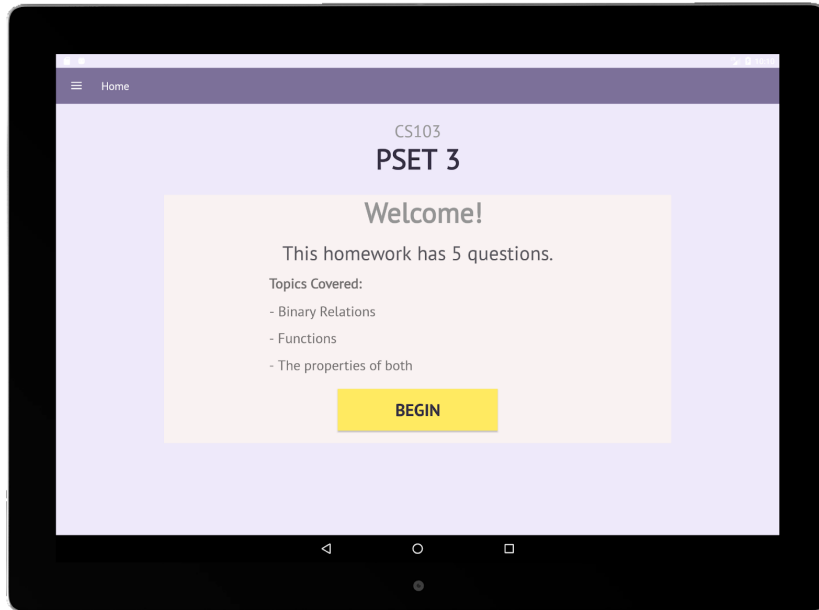


Assignments page

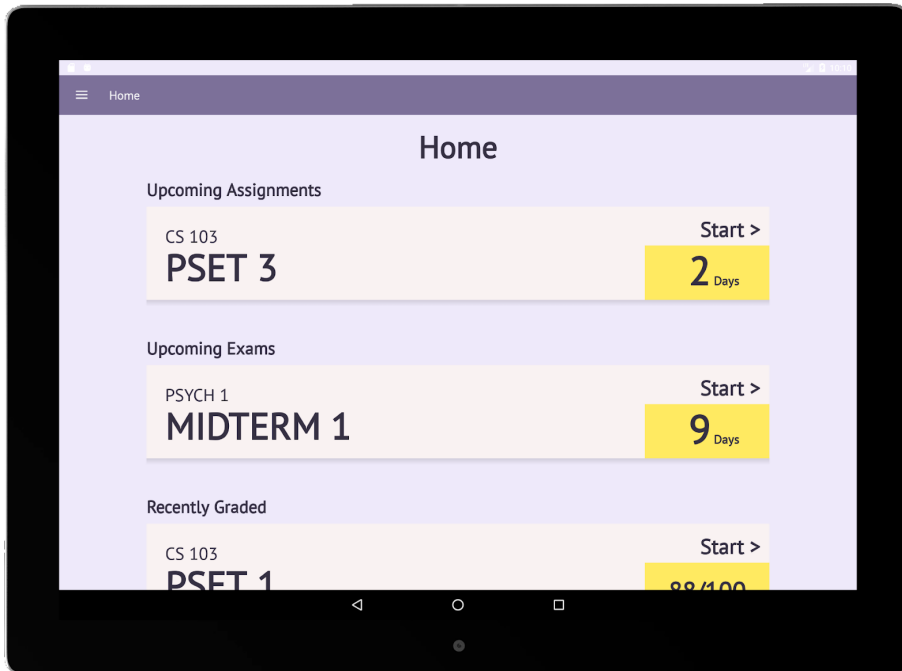
Hi-Fi



Home screen, click PSET 3



PSET 3 Welcome page, click back arrow on tablet

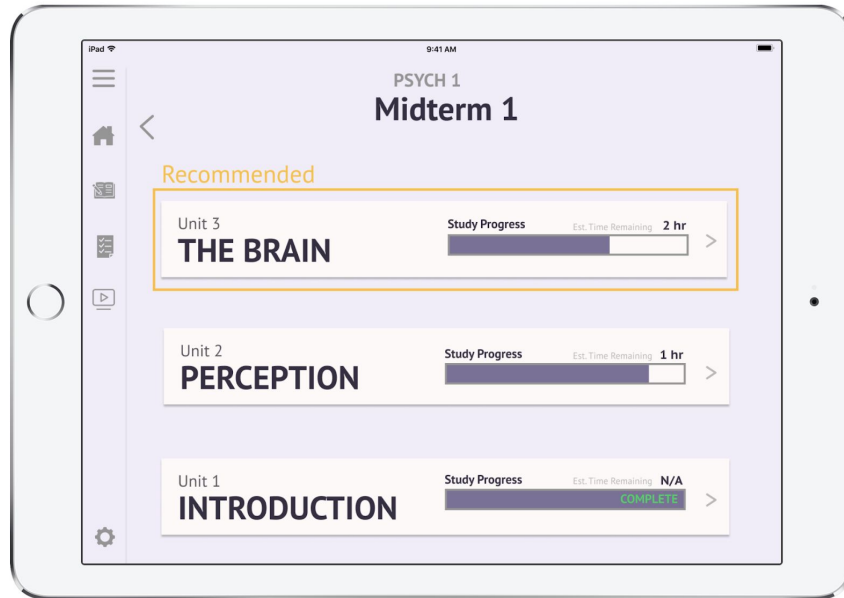


Home screen

Level 3: There should be an explanation of the AI's recommendations as users might not trust AI without reasoning yet.

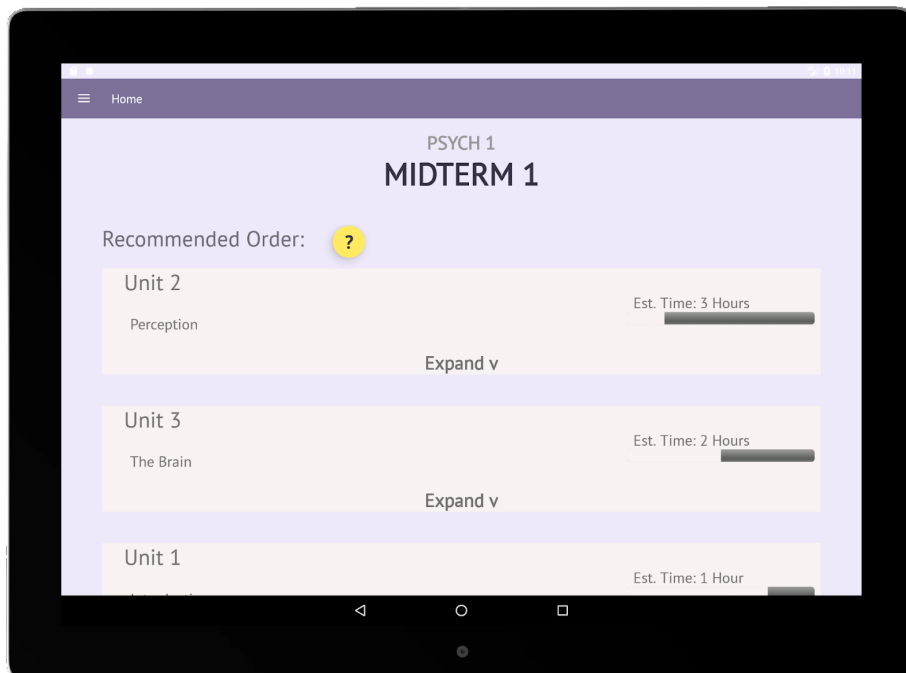
We added a “?” button to the Study Guide page with an explanation of our recommendation algorithm.

Med-Fi

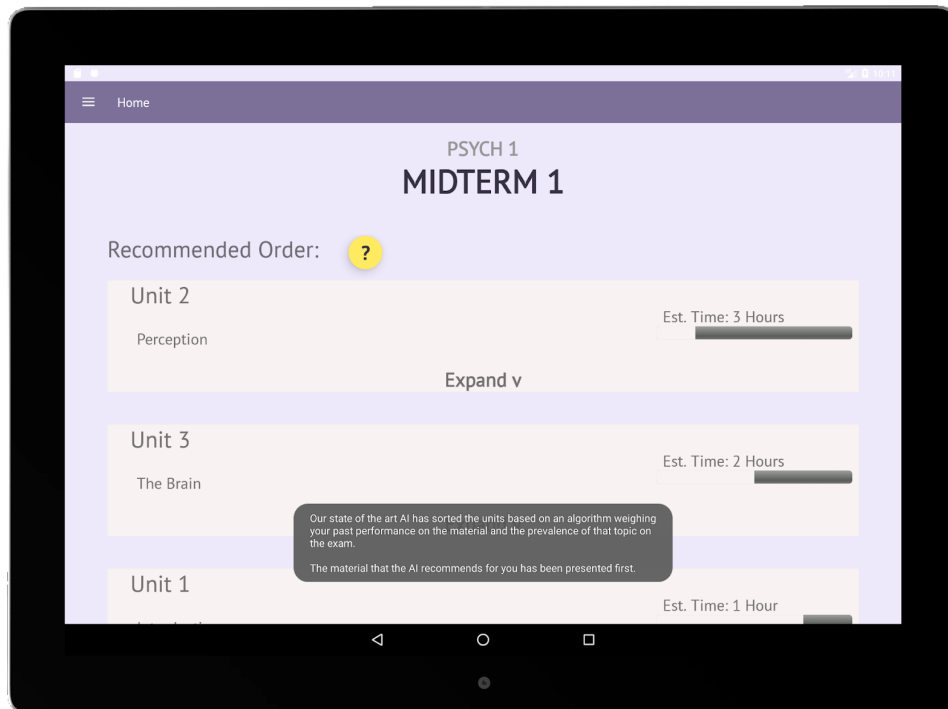


Recommended Unit, no help message

Hi-Fi



Recommended Order, help message (undisplayed), click “?”

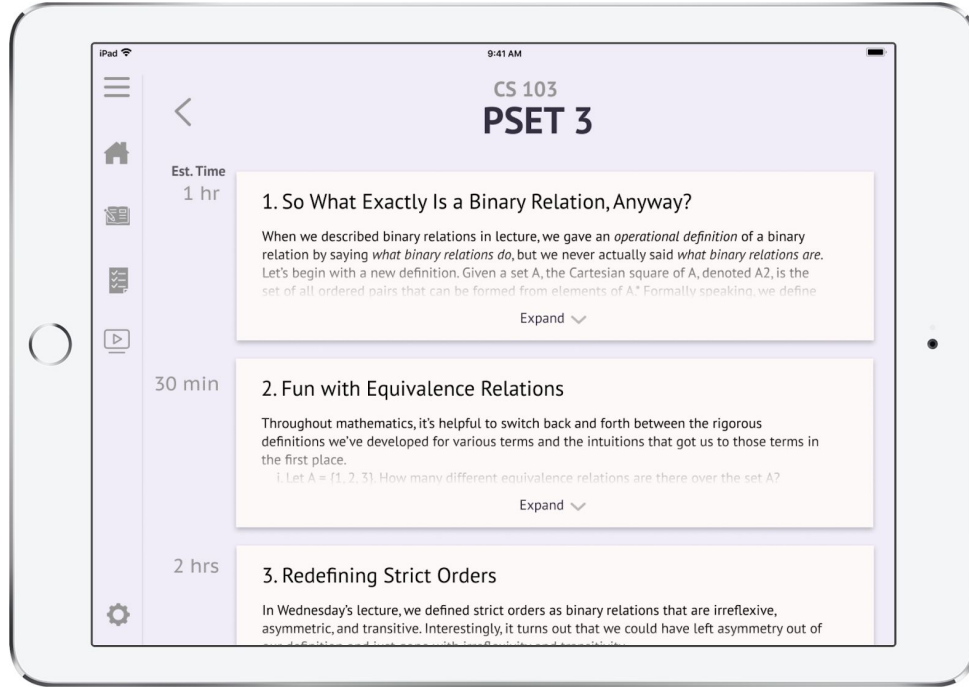


Recommended Order, help message (displayed)

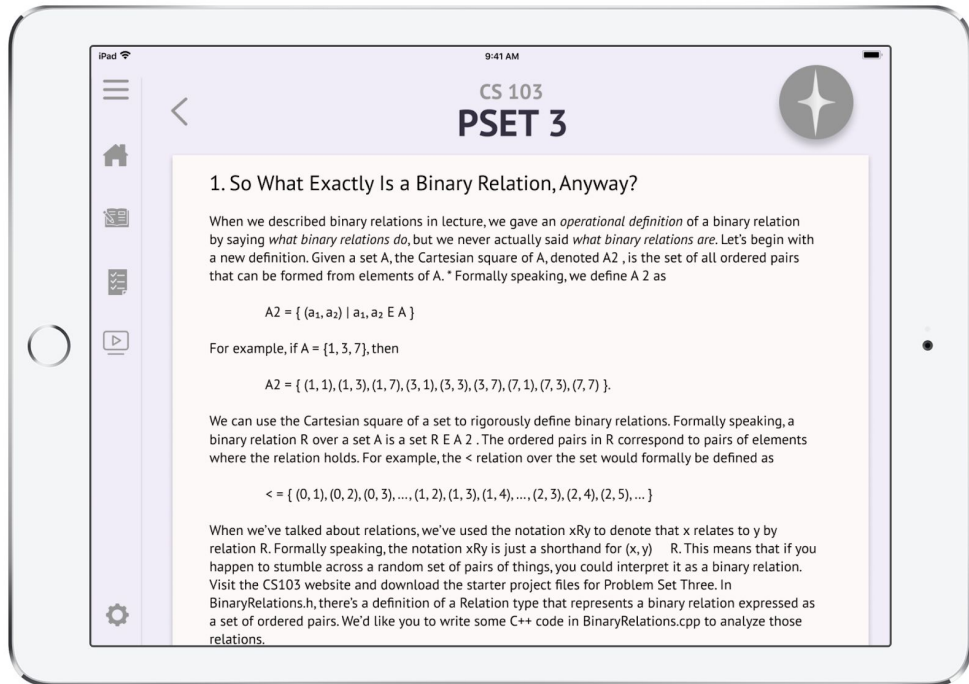
Level 3: The expand option on the recently graded problem set page takes the user to an entirely new page.

This was another limitation we had when using Marvel, and our current prototype has a working expand functionality.

Med-Fi

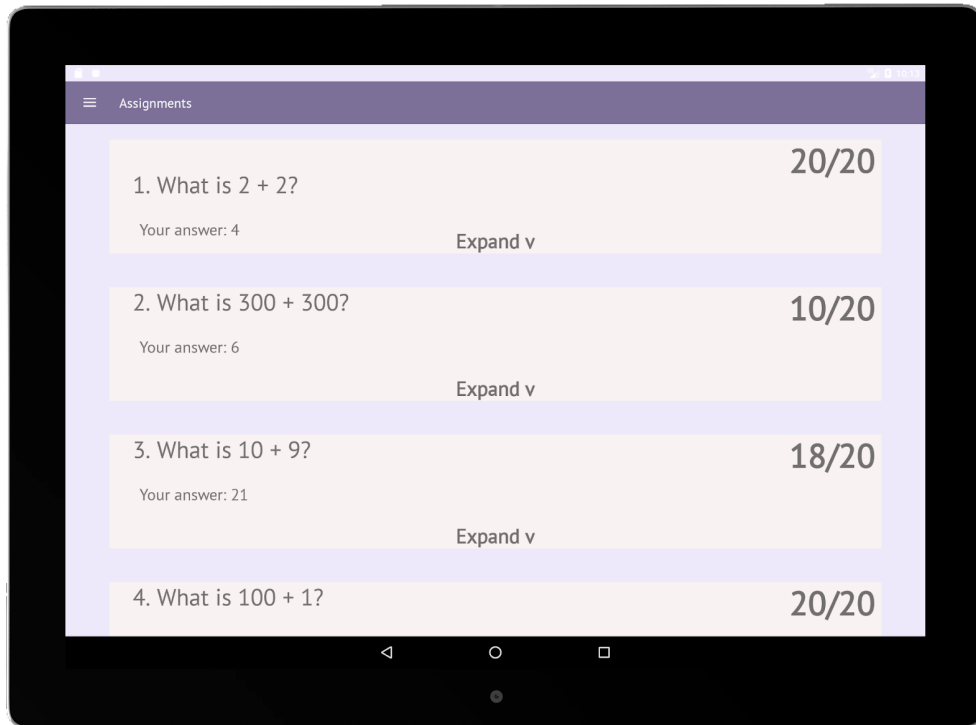


PSET 3 Page, unexpanded, click “Expand” on Problem 1

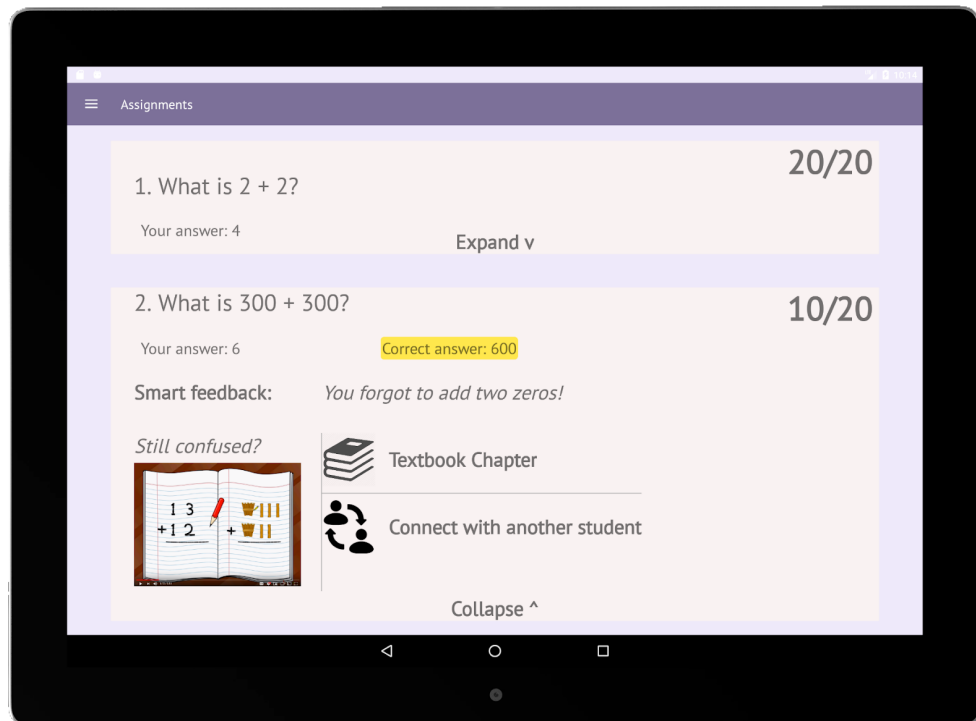


PSET 3 Page, Problem 1 expanded

Hi-Fi



PSET 1 Page, unexpanded, click "Expand" on Problem 2

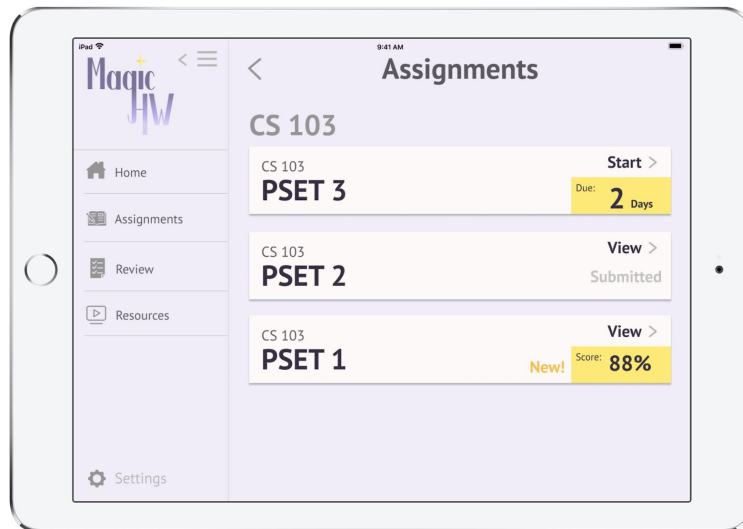


PSET 1 Page, Problem 2 expanded

Level 3: There are two buttons that look like back buttons, and they seem to appear/disappear randomly. One of them is actually a back button and one is to push the menu to the side.

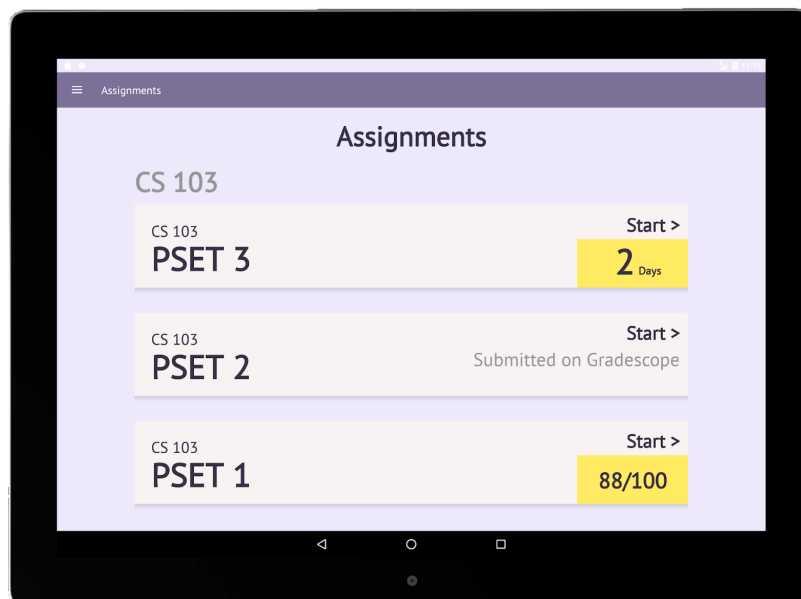
We agreed that having the two back buttons was confusing, so we removed the navigation bar arrow. Furthermore, since we used the Android back button functionality, the back button on the screen was unnecessary, so we removed it.

Med-Fi



Two back buttons in upper left corner

Hi-Fi



No back buttons

Prototype Implementation

Tools

After developing our medium-fi prototype for iOS, we decided to pivot our efforts towards android development. This decision was made due to the fact that Android uses the Java programming language, of which all members were familiar with. Additionally, Richard had experience in Android programming and had educational resources for the rest of the members to use in learning.

In order to make the application, all group members programmed in Android Studio, and used its built-in emulator to test our application. Android Studio was a great platform because it had many built-in tools to help us accomplish our goals. For example, Android Studio's use of xml files meant that most of our screens (except our login) will be able to accommodate to tablets of all sizes. Additionally, android made it very easy for us to implement external functionality (like linking users to websites or videos outside of our application).

Android Studio was unable to help with creating a beautiful logo, so we leveraged Adobe Illustrator in order to create something that we were happy with. Moreover, in order to effectively collaborate as a group, we used Github in order to work in parallel and use a common code-base.

Wizard of Oz

In developing our application, we made use of some Wizard of Oz techniques. We give users recommendations on how much time they should spend studying certain topics, which is based on their performance on exams and previous assignments. We tell the user that this recommendation is derived from an algorithm using artificial intelligence, although it is worth noting that the actual recommendations given in our application are hard-coded time values that we came up with.

Hard-coded Data

We explicitly hard-coded all of the classes that the user is enrolled in, in addition to all of the midterms, assignments, and grades corresponding to those classes. In theory, our application is supposed to be pulling these resources from Gradescope and Canvas, but because we could not implement this functionality, we hard-coded them in. Additionally, all of the links, videos, and student profiles (for peer-to-peer connections) were also hard-coded in.

Missing functionality/ Future Work

Currently, the application is missing fully-fleshed out assignments and exam pages. For example, we allow the user to fully view Problem Set 3 and Problem Set 1 for CS103, but did not code in Problem Set 2. In order to compensate for this, however, we created messages that pop up when an unpopulated assignment/exam is clicked on.

In the future, we would like to add the ability to complete assignments within our application. Since our application is on tablet, we think it would great idea to allow users to be able to handwrite or type out their answers to assignments within MagicHW.

Summary

After 10-weeks of much hard-work in this class, the MagicHW team is very happy with the design process we were able to learn throughout the quarter. We began by interviewing individuals of all ages, from college students to elementary school students to retired individuals. Across these interviews, we found that a lack of resource centralization was very common, allowing us to devise and iterate through various solutions to this issue. After many iterations and evaluations (user testing, heuristic, etc), we were able to leverage our technical skills to realize our solutions through the development of our MagicHW application. After going through this process, our team team has a much greater appreciation for all the work that goes into the everyday products and applications that we use, and we all hope to continue using the skills learned in this class in the future.