TA^{2}I

CS147 – Human Computer Interaction

Section 1

Project Overview

Hi, I'm TA^{2}I, your AI Teaching Assistant!

Value Proposition

TA^{2}I will help to

- Automate feedback with timely insights
- Ensure consistency and fairness in evaluation

Team Members

Violet Crow

Junior ‘26, Symbolic Systems

Shi Han Ang

Maters’25 Learning Design & Tech

Masters’25 CS

Senior’ 25 CS

Polycarpos Yiorkadjis

Masters’ 25 CS

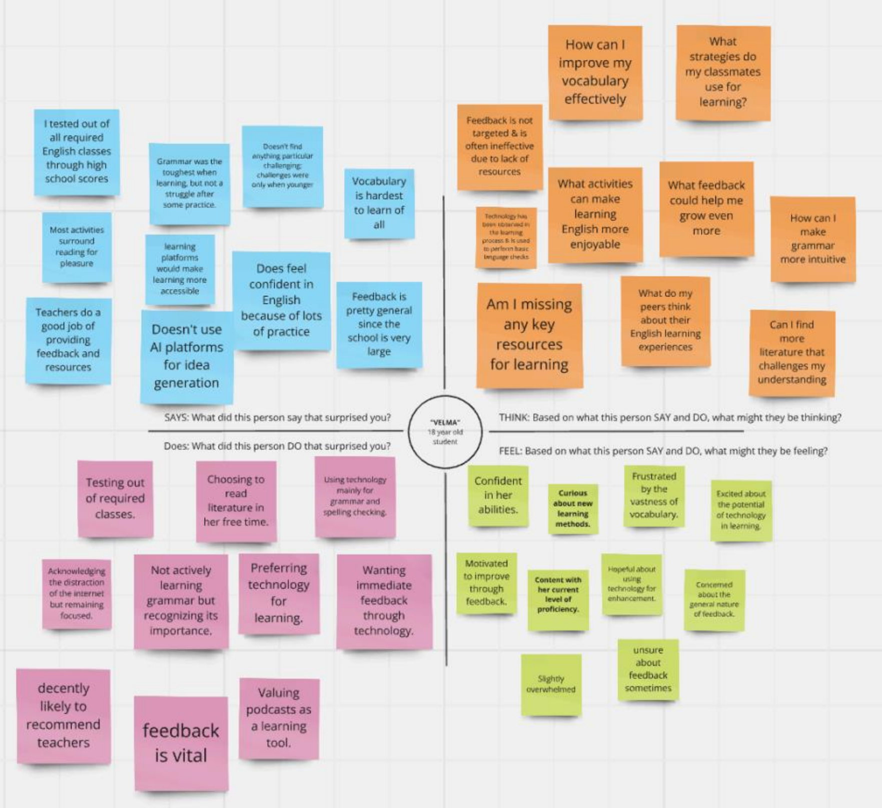
Problem/Solution Overview

Many teachers are overworked, with too many students and not enough time or resources to give each individual student the personalized attention and feedback they need to learn at their best. TA^{2}I gives teachers personalizable AI tools tailored to ELA classrooms, to make the process of grading and giving feedback on student work easy and quick, so they can spend more time and energy on the parts of teaching they love.

Section 2

Needfinding

Empathy Maps



"VELMA" 18 year old student

SAYS: What did this person say that surprised you?

I tested out of all required English classes through high school scores

Grammar was the toughest when learning, but not a struggle after some practice.

Doesn't find anything particular challenging; challenges were only when younger

Vocabulary is hardest to learn of all

Most activities surround reading for pleasure

learning platforms would make learning more accessible

Does feel confident in English because of lots of practice

Feedback is pretty general since the school is very large

Teachers do a good job of providing feedback and resources

Doesn't use AI platforms for idea generation

THINK: Based on what this person SAY and DO, what might they be thinking?

How can I improve my vocabulary effectively

What strategies do my classmates use for learning?

Feedback is not targeted & is often ineffective due to lack of resources

Technology has been observed in the learning process & is used to perform basic language checks.

What activities can make learning English more enjoyable

What feedback could help me grow even more

How can I make grammar more intuitive

Am I missing any key resources for learning

What do my peers think about their English learning experiences

Can I find more literature that challenges my understanding

Does: What did this person DO that surprised you?

Testing out of required classes.

Choosing to read literature in her free time.

Using technology mainly for grammar and spelling checking.

Acknowledging the distraction of the internet but remaining focused.

Not actively learning grammar but recognizing its importance.

Preferring technology for learning.

Wanting immediate feedback through technology.

decently likely to recommend teachers

feedback is vital

Valuing podcasts as a learning tool.

FEEL: Based on what this person SAY and DO, what might they be feeling?

Confident in her abilities.

Curious about new learning methods.

Frustrated by the vastness of vocabulary.

Excited about the potential of technology in learning.

Motivated to improve through feedback.

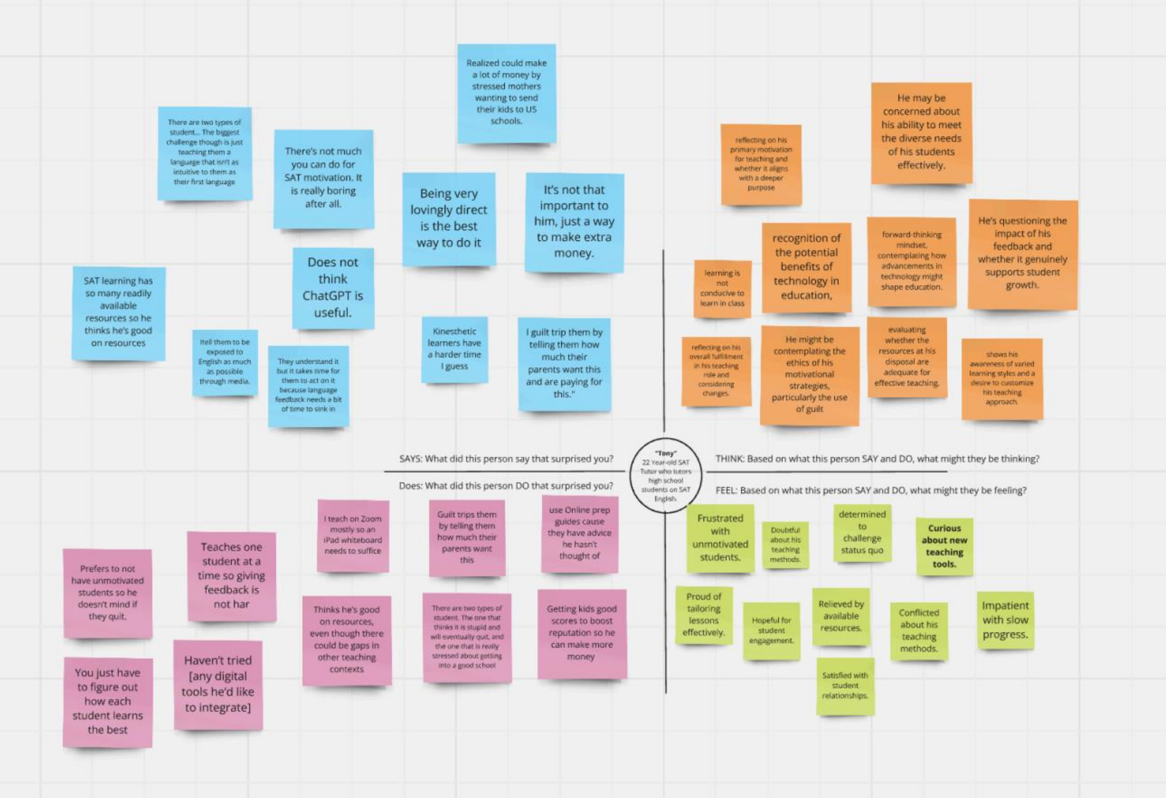
Content with her current level of proficiency.

Hopeful about using technology for enhancement.

Concerned about the general nature of feedback.

Slightly overwhelmed

unsure about feedback sometimes



"Tony" 22 Year-old SAT Tutor who tutors high school students on SAT English.

SAYS: What did this person say that surprised you?

There are two types of student... The biggest challenge though is just teaching them a language that isn't as intuitive to them as their first language

There's not much you can do for SAT motivation. It is really boring after all.

Realized could make a lot of money by stressed mothers wanting to send their kids to US schools.

Being very lovingly direct is the best way to do it

It's not that important to him, just a way to make extra money.

SAT learning has so many readily available resources so he thinks he's good on resources

Does not think ChatGPT is useful.

I tell them to be exposed to English as much as possible through media.

They understand it but it takes time for them to act on it because language feedback needs a bit of time to sink in

Kinesthetic learners have a harder time I guess

I guilt trip them by telling them how much their parents want this and are paying for this."

THINK: Based on what this person SAY and DO, what might they be thinking?

reflecting on his primary motivation for teaching and whether it aligns with a deeper purpose

He may be concerned about his ability to meet the diverse needs of his students effectively.

learning is not conducive to learn in class

recognition of the potential benefits of technology in education,

forward-thinking mindset, contemplating how advancements in technology might shape education.

He's questioning the impact of his feedback and whether it genuinely supports student growth.

reflecting on his overall fulfillment in his teaching role and considering changes.

He might be contemplating the ethics of his motivational strategies, particularly the use of guilt

evaluating whether the resources at his disposal are adequate for effective teaching.

shows his awareness of varied learning styles and a desire to customize his teaching approach.

Does: What did this person DO that surprised you?

I teach on Zoom mostly so an iPad whiteboard needs to suffice

Guilt trips them by telling them how much their parents want this

use Online prep guides cause they have advice he hasn't thought of

Prefers to not have unmotivated students so he doesn't mind if they quit.

Teaches one student at a time so giving feedback is not har

Thinks he's good on resources, even though there could be gaps in other teaching contexts

There are two types of student. The one that thinks it is stupid and will eventually quit, and the one that is really stressed about getting into a good school

Getting kids good scores to boost reputation so he can make more money

You just have to figure out how each student learns the best

Haven't tried [any digital tools he'd like to integrate]

FEEL: Based on what this person SAY and DO, what might they be feeling?

Frustrated with unmotivated students.

Doubtful about his teaching methods.

determined to challenge status quo

Curious about new teaching tools.

Proud of tailoring lessons effectively.

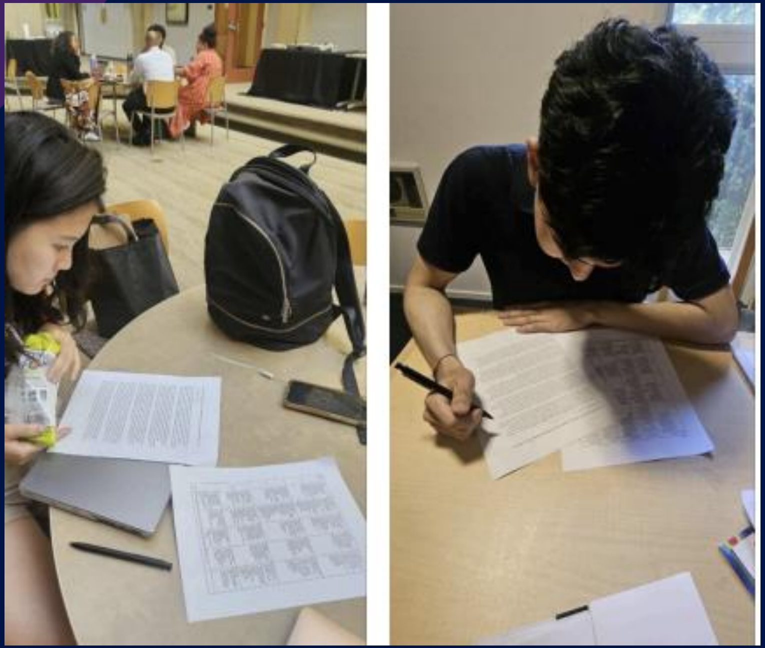
Hopeful for student engagement.

Relieved by available resources.

Conflicted about his teaching methods.

Impatient with slow progress.

Satisfied with student relationships.



Interviews: Participant Recruitment and Interaction

Across two rounds, we interviewed four teachers and two students. The teachers were an SAT English tutor for high schoolers, two high school teachers, and one teacher with experience in K-12. The students were an 18 year old high school graduate, and a 9 year old currently in the K-12 system. We recruited participants through both personal connections and cold approaches in the Stanford Graduate School of Education, and in local area high schools.

Participants were not compensated.

Interviews were conducted by two members of our team, and involved a mix of pre-scripted and spontaneous questions, with different sets for the teachers than for the students. Some interviews were recorded and later transcribed, while others for which the interviewee did not wish to be recorded only had notes taken during the interview.

Synthesis: Insights and Learnings

Our process

We synthesized information for each interview into empathy maps, collaborating to make observations on each interviewee’ s thoughts, feelings, words, and actions. Following this, for each interviewee, we generated a Point-of-View statement to summarize what we learned from them. We had key insights in a number of areas, from across all of our interviews.

01

From Teachers

Personalized learning is important and effective for student learning; feedback takes time for students to internalize; unmotivated students tend not to pay much attention to standard feedback.

02

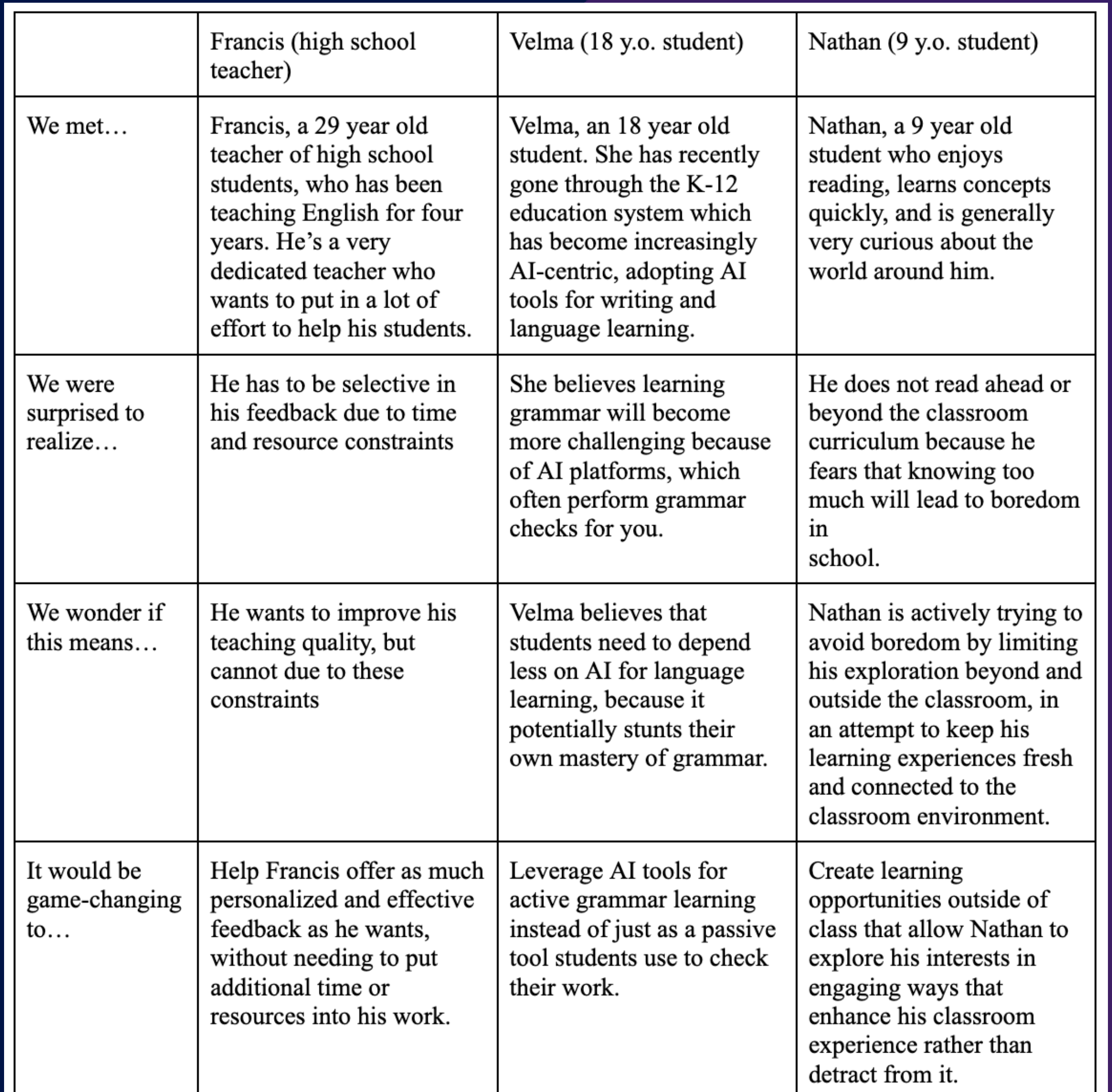
From Students

Feedback is often not targeted towards their individual needs, and is often ineffective as a result; technology is often used as part of the learning process in modern classroom environments; personalized lessons are more captivating.

Section 3

POVs & Experience Prototypes

Final POV Statements



	Francis (high school teacher)	Velma (18 y.o. student)	Nathan (9 y.o. student)
We met…	Francis, a 29 year old teacher of high school students, who has been teaching English for four years. He’s a very dedicated teacher who wants to put in a lot of effort to help his students.	Velma, an 18 year old student. She has recently gone through the K-12 education system which has become increasingly AI-centric, adopting AI tools for writing and language learning.	Nathan, a 9 year old student who enjoys reading, learns concepts quickly, and is generally very curious about the world around him.
We were surprised to realize…	He has to be selective in his feedback due to time and resource constraints	She believes learning grammar will become more challenging because of AI platforms, which often perform grammar checks for you.	He does not read ahead or beyond the classroom curriculum because he fears that knowing too much will lead to boredom in school.
We wonder if this means…	He wants to improve his teaching quality, but cannot due to these constraints	Velma believes that students need to depend less on AI for language learning, because it potentially stunts their own mastery of grammar.	Nathan is actively trying to avoid boredom by limiting his exploration beyond and outside the classroom, in an attempt to keep his learning experiences fresh and connected to the classroom environment.
It would be game-changing to…	Help Francis offer as much personalized and effective feedback as he wants, without needing to put additional time or resources into his work.	Leverage AI tools for active grammar learning instead of just as a passive tool students use to check their work.	Create learning opportunities outside of class that allow Nathan to explore his interests in engaging ways that enhance his classroom experience rather than detract from it.

HMWs Derived from Francis

01

HMW integrate technology to make Francis'　feedback process quick, easy and effective? (FOCUS)

02

HMW make feedback more collaborative, allowing students to contribute and reduce demand on Francis?

03

HMW prioritize key areas of feedback so Francis can focus on what'　s impactful?

HMWs Derived from Nathan

01

HMW leverage AI to adapt grammar lessons for Velma based on real-world language patterns and student needs? (FOCUS)

02

HMW create immersive realistic environments where Velma can practice her grammar skills?

03

HMW help Velma reduce her dependence on tools like spell-check, autocorrect, etc?

HMWs Derived from Velma

01

HMW rely on AI to offer learning activities that complement what he’ s learning in class? (FOCUS)

02

How might we use technology to connect Nathan’ s reading interests with relevant class topics?

03

How might we create reading solutions where Nathan can share his interests and make meaningful connections to class content?

Top 3 Solutions from Brainstorming

FRANCIS

A system that creates diagnostic assessments for language subjects. It scans students' work, identifies areas for improvement, and provides written feedback. It also generates personalized practice problems in grammar, spelling, and other language skills.

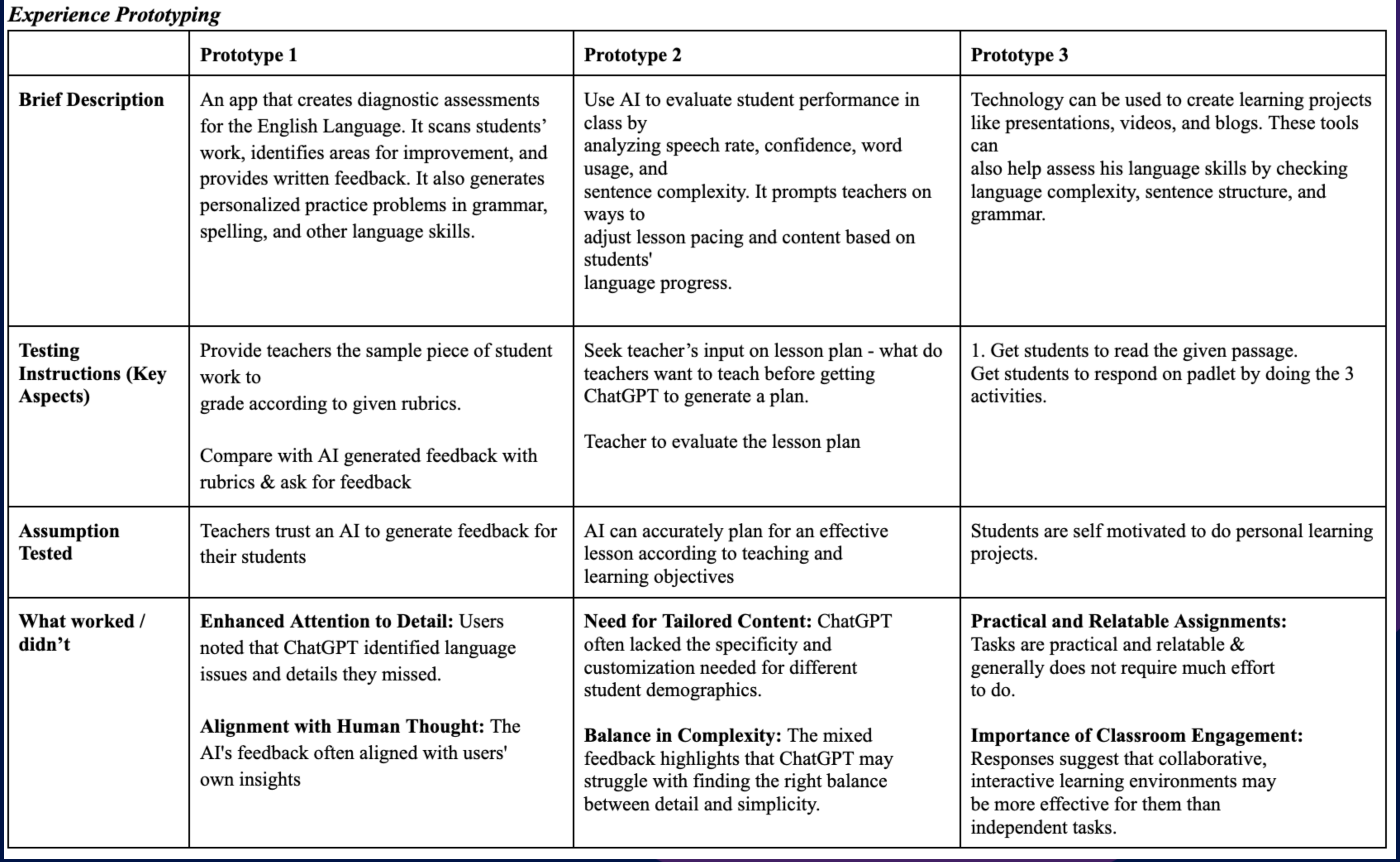
VELMA

Use AI to evaluate student performance in class by analyzing speech rate, confidence, word usage, and sentence complexity in live conversation. It prompts teachers on ways to adjust lesson pacing and content based on students' language progress.

NATHAN

A technology platform to help create independent learning projects like presentations, videos, and blogs. These tools can also help assess his language skills by checking his language complexity, sentence structure, and grammar.

Experience Prototype Descriptions



Experience Prototyping

	Prototype 1	Prototype 2	Prototype 3
Brief Description	An app that creates diagnostic assessments for the English Language. It scans students' work, identifies areas for improvement, and provides written feedback. It also generates personalized practice problems in grammar, spelling, and other language skills.	Use AI to evaluate student performance in class by analyzing speech rate, confidence, word usage, and sentence complexity. It prompts teachers on ways to adjust lesson pacing and content based on students' language progress.	Technology can be used to create learning projects like presentations, videos, and blogs. These tools can also help assess his language skills by checking language complexity, sentence structure, and grammar.
Testing Instructions (Key Aspects)	Provide teachers the sample piece of student work to grade according to given rubrics. Compare with AI generated feedback with rubrics & ask for feedback	Seek teacher's input on lesson plan - what do teachers want to teach before getting ChatGPT to generate a plan. Teacher to evaluate the lesson plan	1. Get students to read the given passage. Get students to respond on padlet by doing the 3 activities.
Assumption Tested	Teachers trust an AI to generate feedback for their students	AI can accurately plan for an effective lesson according to teaching and learning objectives	Students are self motivated to do personal learning projects.
What worked / didn't	**Enhanced Attention to Detail:** Users noted that ChatGPT identified language issues and details they missed. **Alignment with Human Thought:** The AI's feedback often aligned with users' own insights	**Need for Tailored Content:** ChatGPT often lacked the specificity and customization needed for different student demographics. **Balance in Complexity:** The mixed feedback highlights that ChatGPT may struggle with finding the right balance between detail and simplicity.	**Practical and Relatable Assignments:** Tasks are practical and relatable & generally does not require much effort to do. **Importance of Classroom Engagement:** Responses suggest that collaborative, interactive learning environments may be more effective for them than independent tasks.

Section 4

Design Evolution

Final Solution Description and Rationale

Our final chosen solution was the diagnostic assessment and feedback system, which we decided to realize as an app. The app implementation was chosen because most teachers already have access to smartphones, and because unique features of modern smartphones – high quality cameras, touch interfaces, easy integration with other app-based LMS like Google Classroom and Canvas, and more – result in a system that is easier to acquire, learn, and use for teachers.

The solution itself was chosen due to the frequency, density, and pain of the specific problem it addresses. Feedback is a frequent problem: every major assessment necessitates feedback, whether it' s marking answers on a worksheet, test, or quiz, or providing comments on an essay or other writing assignment.

It has high-density: teachers across the country, across all grade levels, across numerous subjects and courses, deal with giving feedback. Finally, the time sink is more than just a small annoyance, especially for teachers in underfunded schools who are expected to teach and give individual attention and feedback to multiple classes, with some having over fifty students per class.

Task Descriptions and Complexity

01

Simple Task

Track a student’ s progress in ELA skill areas over time.

- Part of giving the best feedback possible to students is understanding where they’ re at with certain skills, and where they need to improve, which is why we have built into our solution an automated assessment of student skills in certain areas based on their work, and an area to view their progress over time. This task was given to testers as “Please view the progress of a 6th grade English student, James L., in Reading Comprehension over time.”

02

Moderate Task

Assess a student’ s work on an assignment and provide detailed, helpful feedback.

- This task replicates something most teachers are asked to do for each student on every assignment, making it a crucial area to save them time. This task was given to testers as “Please create and submit feedback on student James L’ s work on Assignment 1” .

03

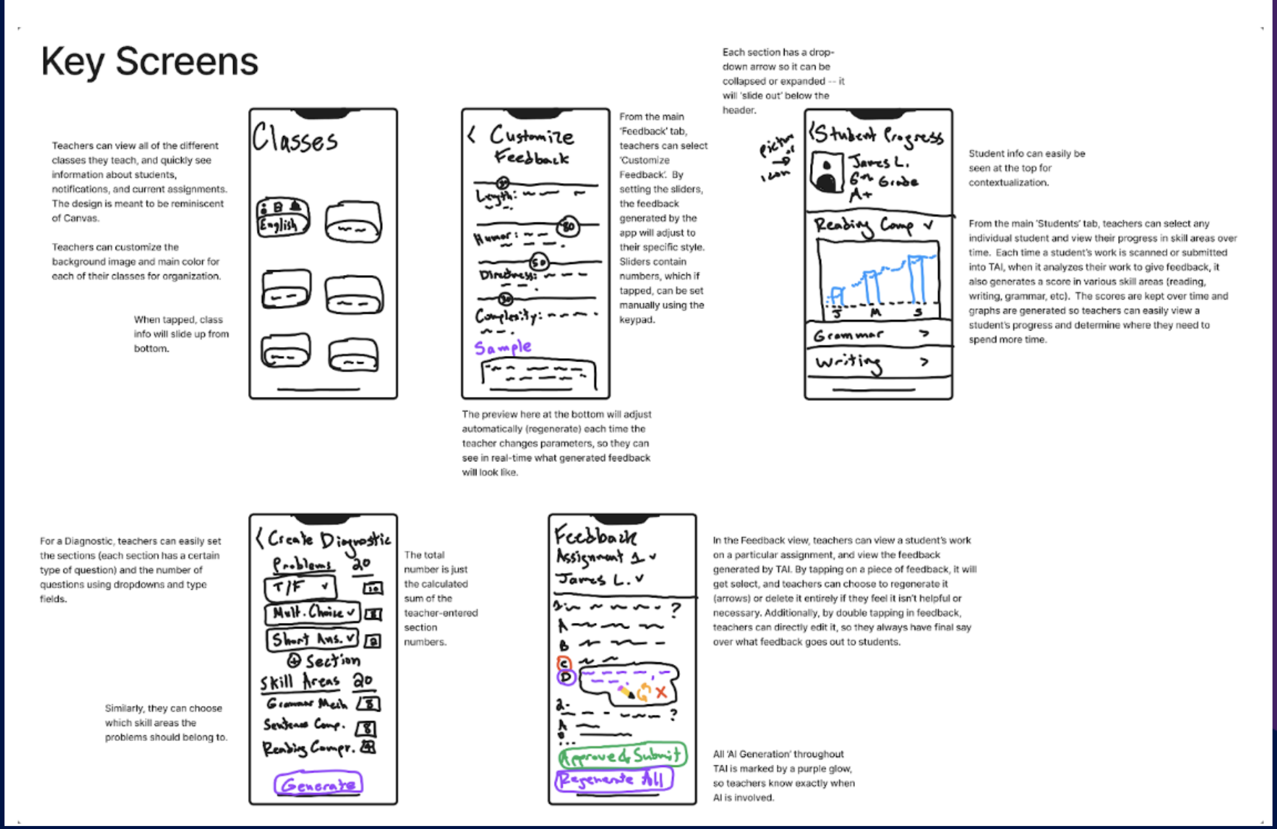
Complex Task

Create a targeted quiz to assess students’ skills in specified areas.

- This task is an additional part of many teachers’ workflow, as determining the problem areas of their classes and individual students to be addressed later is essential to effective pedagogy. This task was given to testers as “Please create a quiz with 20 true/false grammar questions.”

Visualization and Rationale

For this project, we had three major iterations of UI: our low-fidelity prototype, which was sketched in FigJam, a medium-fidelity prototype created in Figma, and a high-fidelity prototype in the form of an actual application built using React Native.



Key Screens

Teachers can view all of the different classes they teach, and quickly see information about students, notifications, and current assignments. The design is meant to be reminiscent of Canvas.

Teachers can customize the background image and main color for each of their classes for organization.

When tapped, class info will slide up from bottom.

From the main 'Feedback' tab, teachers can select 'Customize Feedback'. By setting the sliders, the feedback generated by the app will adjust to their specific style. Sliders contain numbers, which if tapped, can be set manually using the keypad.

The preview here at the bottom will adjust automatically (regenerate) each time the teacher changes parameters, so they can see in real-time what generated feedback will look like.

Each section has a drop-down arrow so it can be collapsed or expanded -- it will 'slide out' below the header.

Student info can easily be seen at the top for contextualization.

From the main 'Students' tab, teachers can select any individual student and view their progress in skill areas over time. Each time a student's work is scanned or submitted into TAI, when it analyzes their work to give feedback, it also generates a score in various skill areas (reading, writing, grammar, etc). The scores are kept over time and graphs are generated so teachers can easily view a student's progress and determine where they need to spend more time.

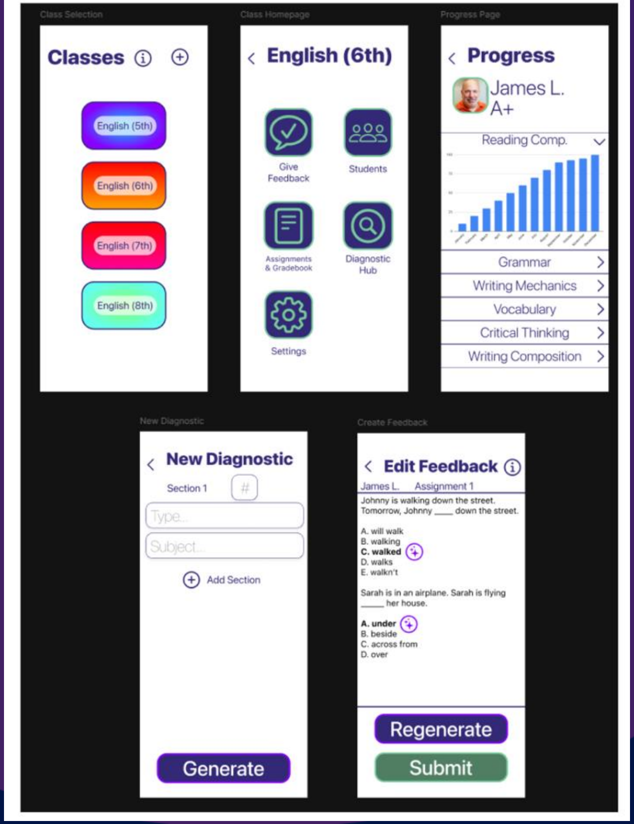
For a Diagnostic, teachers can easily set the sections (each section has a certain type of question) and the number of questions using dropdowns and type fields.

Similarly, they can choose which skill areas the problems should belong to.

The total number is just the calculated sum of the teacher-entered section numbers.

In the Feedback view, teachers can view a student's work on a particular assignment, and view the feedback generated by TAI. By tapping on a piece of feedback, it will get select, and teachers can choose to regenerate it (arrows) or delete it entirely if they feel it isn't helpful or necessary. Additionally, by double tapping in feedback, teachers can directly edit it, so they always have final say over what feedback goes out to students.

All 'AI Generation' throughout TAI is marked by a purple glow, so teachers know exactly when AI is involved.



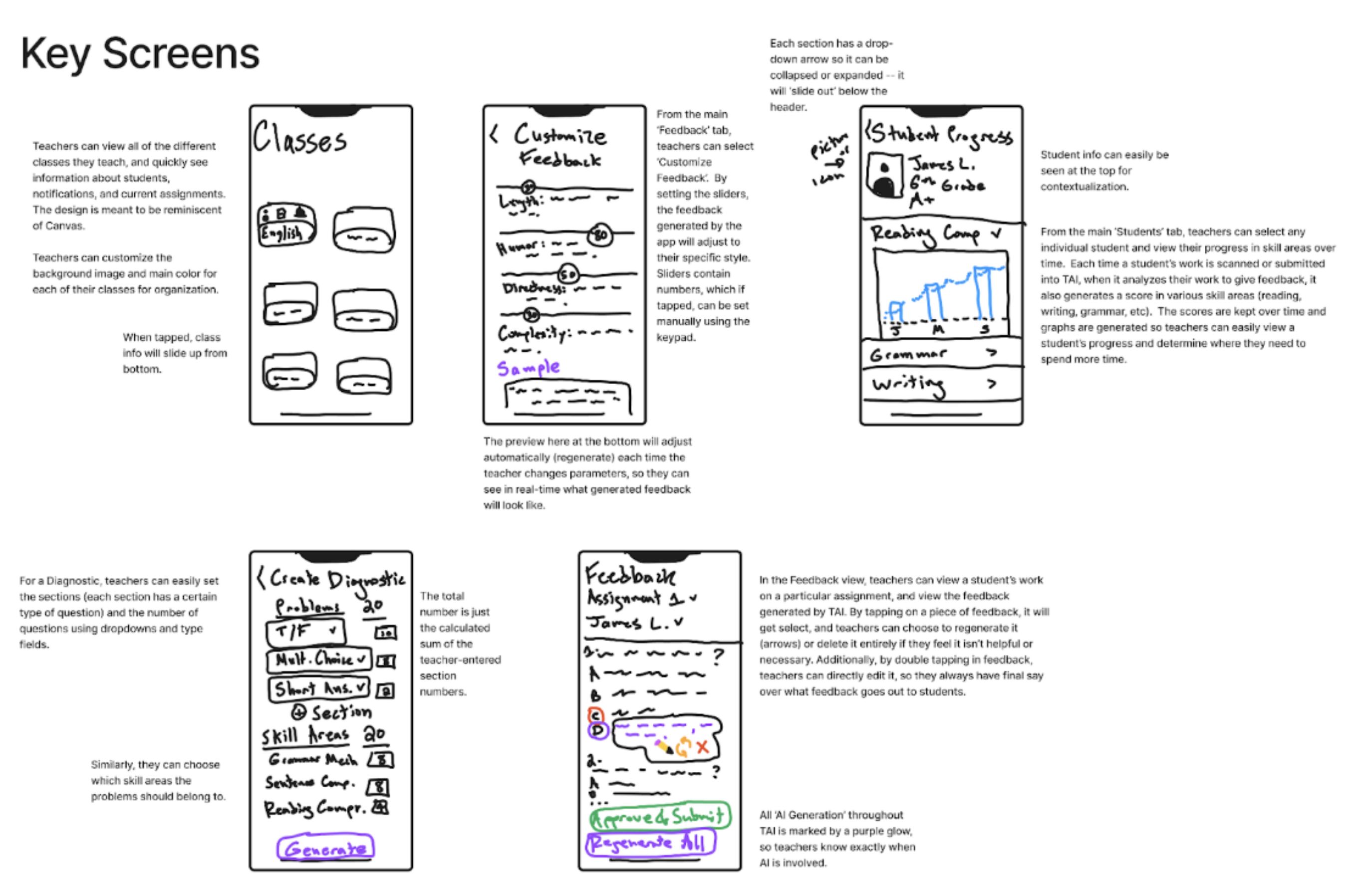
Johnny is walking down the street. Tomorrow, Johnny ____ down the street.

A. will walk
B. walking
C. walked
D. walks
E. walkn't

Sarah is in an airplane. Sarah is flying ____ her house.

A. under
B. beside
C. across from
D. over

Annotated Task-Flows



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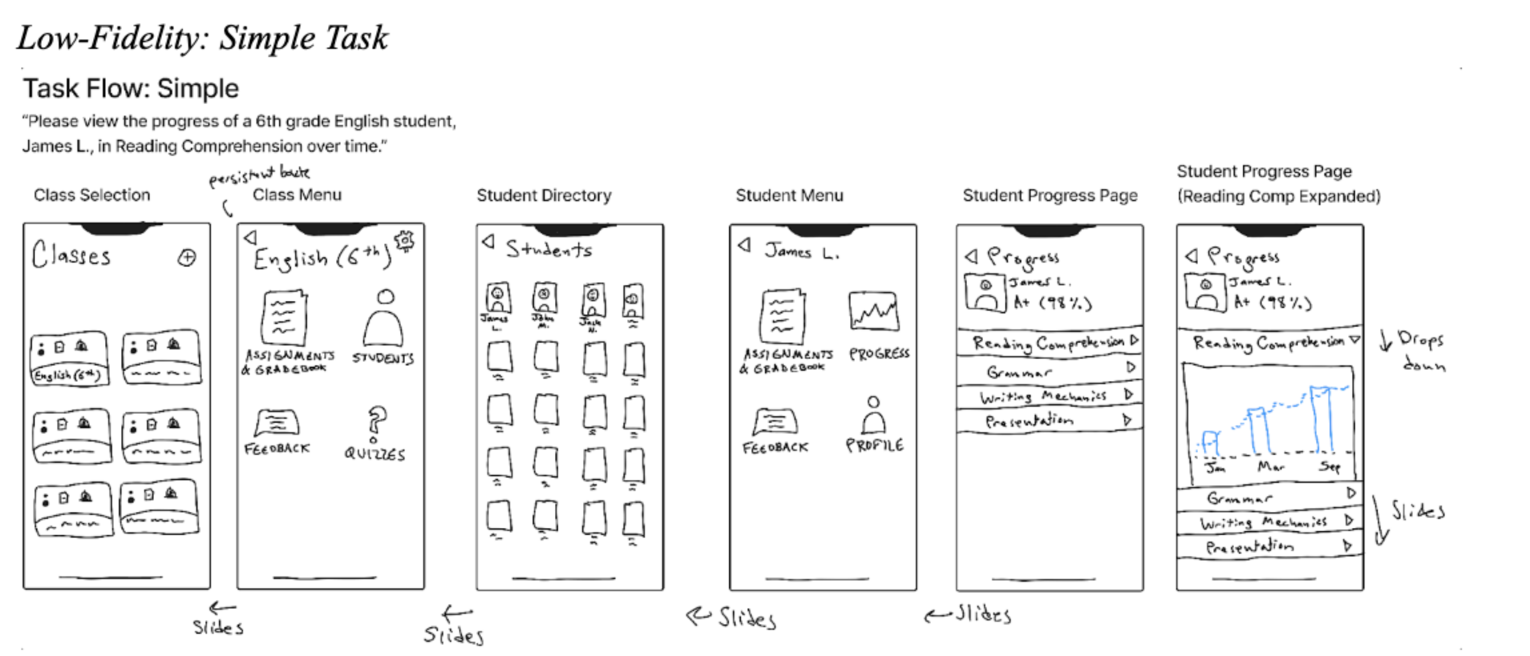
As seen in the key screens, the low-fi prototype was purposefully as sketch-like as possible: handwritten text, colors only where necessary, and plenty of ill-defined shapes and greeked text throughout.

The only non-hand drawn element is the border of the phone screen itself, for consistency. The low-fi prototype was meant to determine basic principles of layout, task flow, sizing, and interaction. Though future iterations would look very different and far more polished, the layout and procedure from this version of the UI noticeably remains nearly the same even through our final UI iteration in many areas.

This version was tested by providing users with a printed-on-paper version of each screen of our UI. One member of the group explained the basic premise of the test, while another acted as the 'computer', controlling which screen was shown to users as they tapped elements as if using a smartphone.

As a result of our testing, we discovered a few common problem areas to address for future iterations, including redundancy of feature pathways, confusion over some word choices used, and a lack of clear and consistent header information. Included below are all three task-flows, the screens from which were presented to users testing this version of the UI.

Annotated Task-Flows



Low-Fidelity: Simple Task

Task Flow: Simple

"Please view the progress of a 6th grade English student, James L., in Reading Comprehension over time."

Class Selection

Class Menu

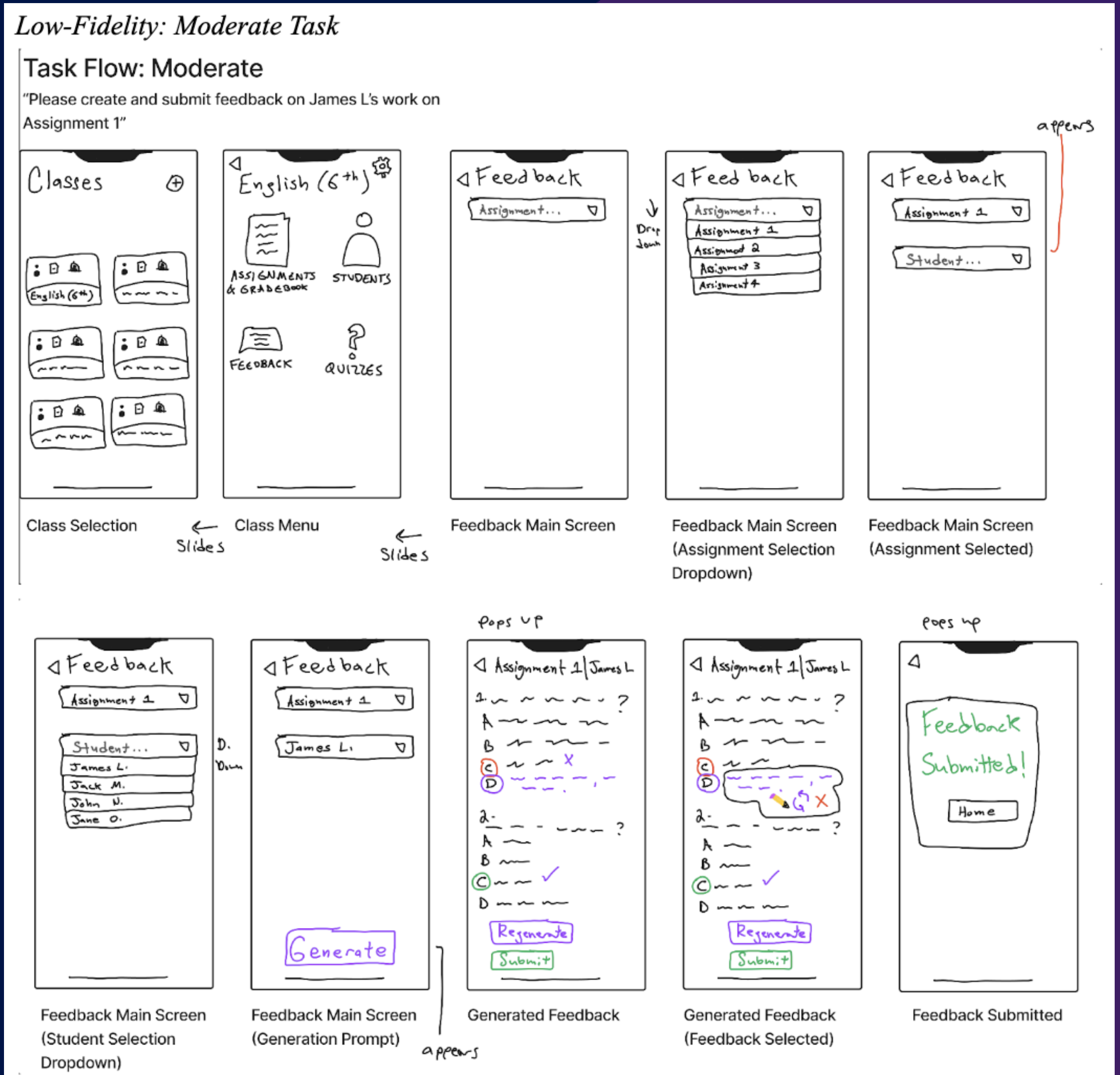
Student Directory

Student Menu

Student Progress Page

Student Progress Page (Reading Comp Expanded)

Annotated Task-Flows



Low-Fidelity: Moderate Task

Task Flow: Moderate

"Please create and submit feedback on James L's work on Assignment 1"

Class Selection

Class Menu

Feedback Main Screen

Feedback Main Screen (Assignment Selection Dropdown)

Feedback Main Screen (Assignment Selected)

Feedback Main Screen (Student Selection Dropdown)

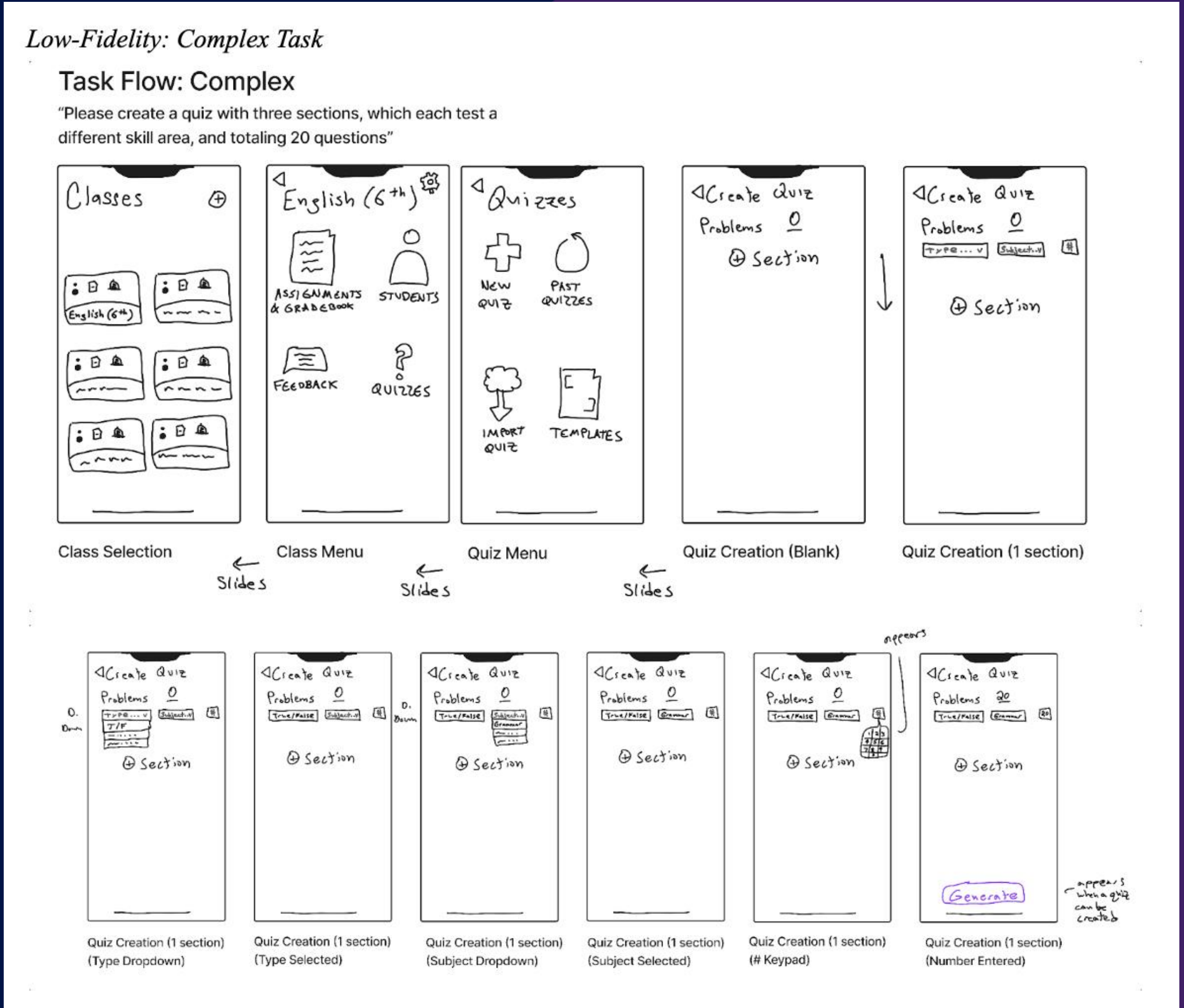
Feedback Main Screen (Generation Prompt)

Generated Feedback

Generated Feedback (Feedback Selected)

Feedback Submitted

Annotated Task-Flows



Low-Fidelity: Complex Task

Task Flow: Complex

"Please create a quiz with three sections, which each test a different skill area, and totaling 20 questions"

Class Selection

Class Menu

Quiz Menu

Quiz Creation (Blank)

Quiz Creation (1 section)

Quiz Creation (1 section) (Type Dropdown)

Quiz Creation (1 section) (Type Selected)

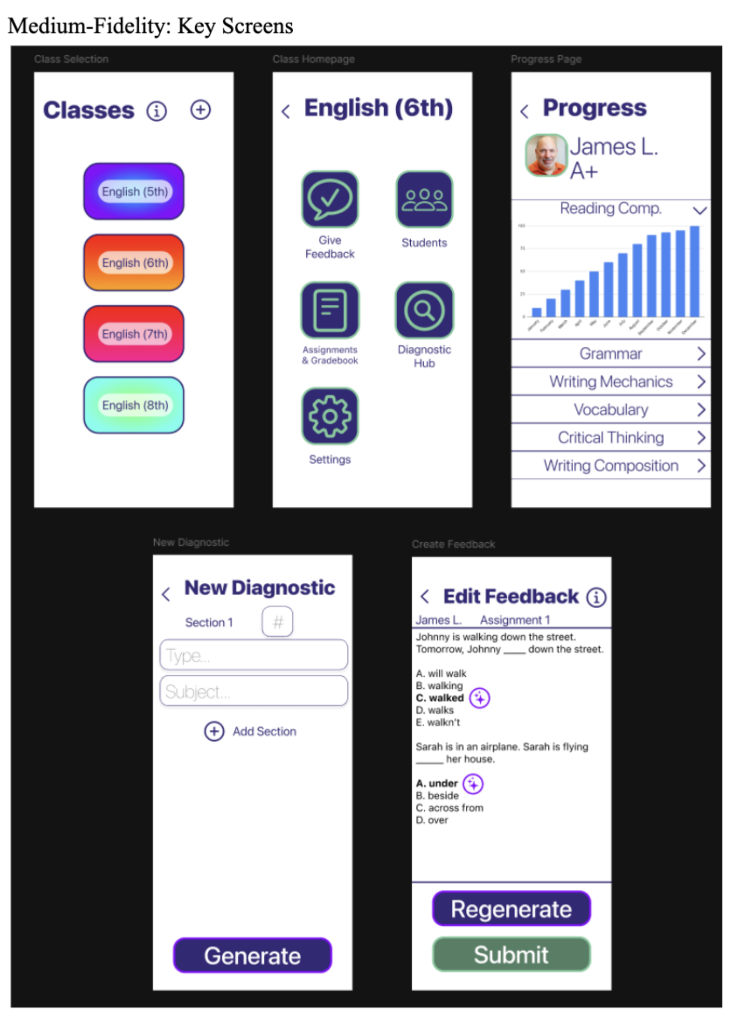
Quiz Creation (1 section) (Subject Dropdown)

Quiz Creation (1 section) (Subject Selected)

Quiz Creation (1 section) (# Keypad)

Quiz Creation (1 section) (Number Entered)

Annotated Task-Flows


Medium-Fidelity: Key Screens

Johnny is walking down the street. Tomorrow, Johnny ____ down the street.

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B. walking
C. walked
D. walks
E. walkn't

Sarah is in an airplane. Sarah is flying _____ her house.

A. under
B. beside
C. across from
D. over

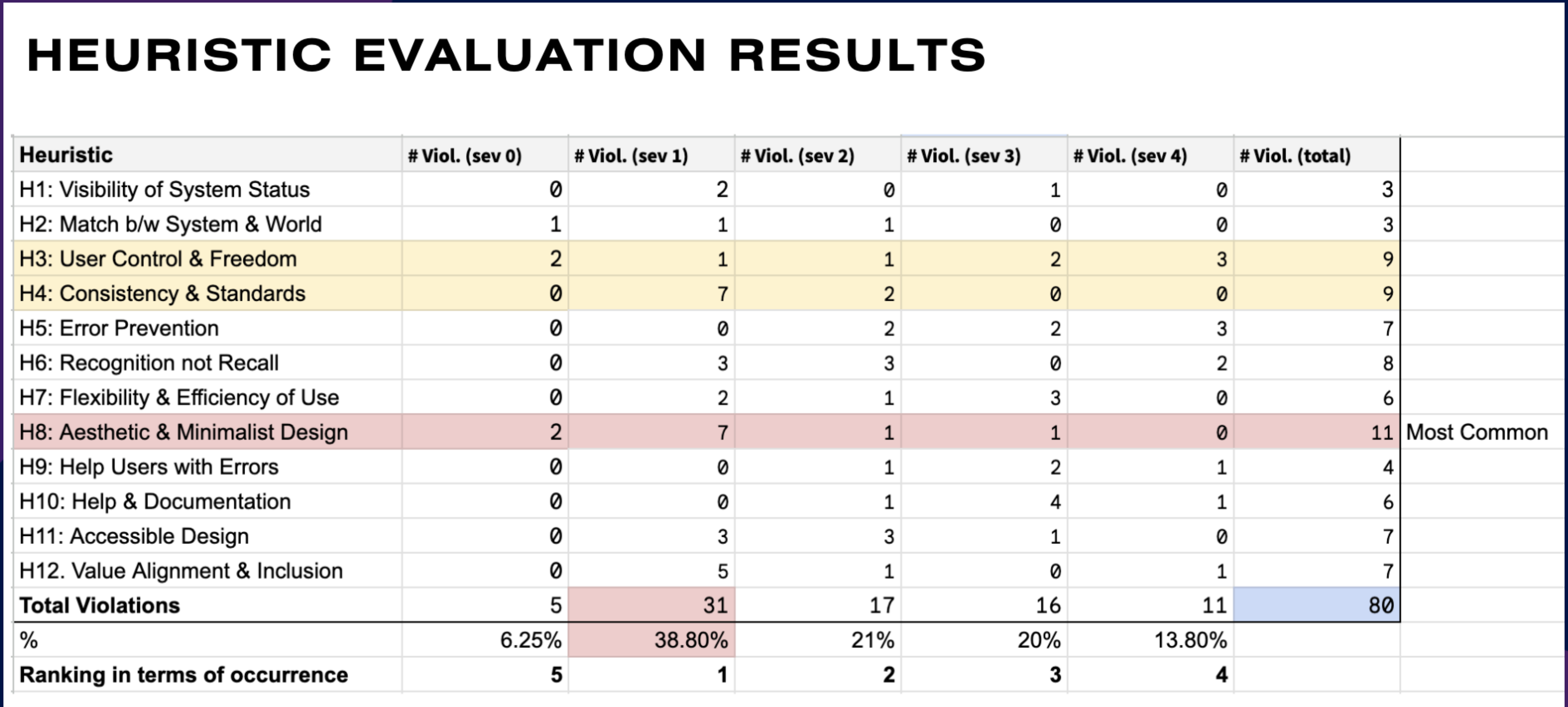
Moving onto the medium-fidelity prototype, which was constructed in Figma, the increase in visual fidelity immediately becomes clear, as seen in these key screens. Colors, typed text, structured buttons and icons, and more bring far better readability and intuition to the UI.

While less clear from the still image, user interaction was also greatly improved: Figma's prototyping feature meant that every button, icon, dropdown field, etc. was fully interactable (though some interaction, like typing in a number, had to be 'emulated' due to Figma's limitations) and page transitions were far more smooth and consistent than in the paper version.

This UI went through some minor revisions after we received feedback in Studio; this led to changes like the addition of a tutorial flow, an improved color scheme, and a change to the way feedback was placed on top of student work.

This UI was tested via a heuristic evaluation: users were provided with a link to the Figma prototype itself and asked to find violations of 12 usability heuristics throughout the prototype/design. These violations were compiled into a report, which we used as we progressed into building the high-fidelity prototype.

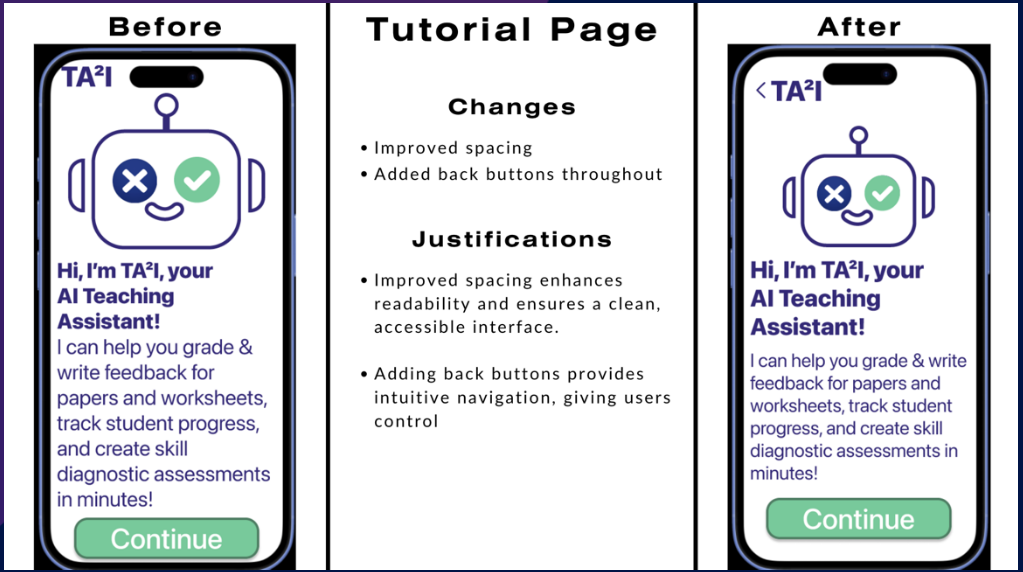
Heuristic Violations and Fixes



HEURISTIC EVALUATION RESULTS

Heuristic	# Viol. (sev 0)	# Viol. (sev 1)	# Viol. (sev 2)	# Viol. (sev 3)	# Viol. (sev 4)	# Viol. (total)	
H1: Visibility of System Status	0	2	0	1	0	3	
H2: Match b/w System & World	1	1	1	0	0	3	
H3: User Control & Freedom	2	1	1	2	3	9	
H4: Consistency & Standards	0	7	2	0	0	9	
H5: Error Prevention	0	0	2	2	3	7	
H6: Recognition not Recall	0	3	3	0	2	8	
H7: Flexibility & Efficiency of Use	0	2	1	3	0	6	
H8: Aesthetic & Minimalist Design	2	7	1	1	0	11	Most Common
H9: Help Users with Errors	0	0	1	2	1	4	
H10: Help & Documentation	0	0	1	4	1	6	
H11: Accessible Design	0	3	3	1	0	7	
H12. Value Alignment & Inclusion	0	5	1	0	1	7	
Total Violations	5	31	17	16	11	80	
%	6.25%	38.80%	21%	20%	13.80%		
Ranking in terms of occurrence	**5**	**1**	**2**	**3**	**4**		

Heuristic Violations and Fixes



Before

TA²I

Hi, I'm TA²I, your AI Teaching Assistant!

I can help you grade & write feedback for papers and worksheets, track student progress, and create skill diagnostic assessments in minutes!

Continue

Tutorial Page

Changes

- Improved spacing
- Added back buttons throughout

Justifications

- Improved spacing enhances readability and ensures a clean, accessible interface.
- Adding back buttons provides intuitive navigation, giving users control

After

‹ TA²I

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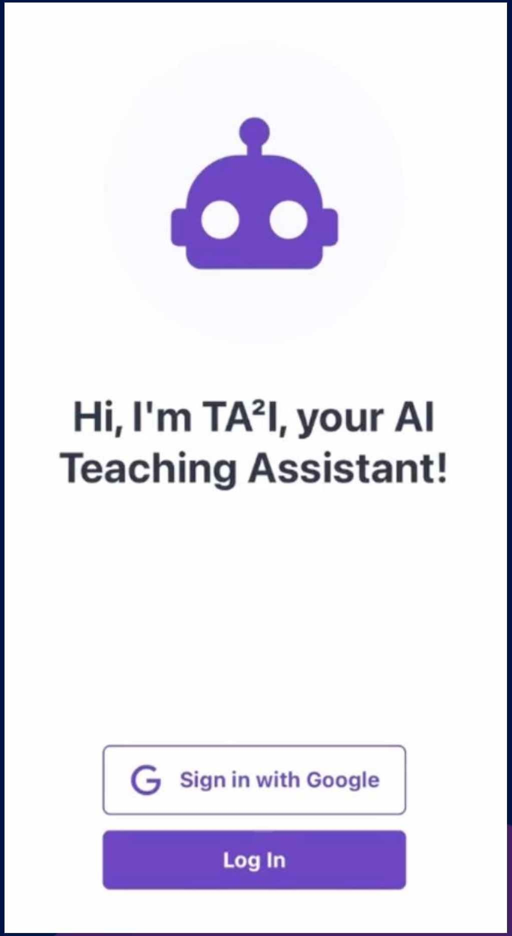
Continue

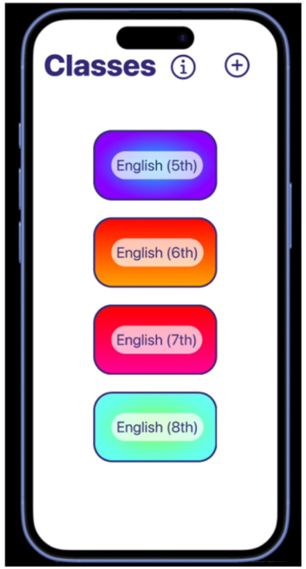


Hi, I'm TA²I, your AI Teaching Assistant!

Mid -> Hi-Fi

Heuristic Violations and Fixes

Before



Homepage (Classes)

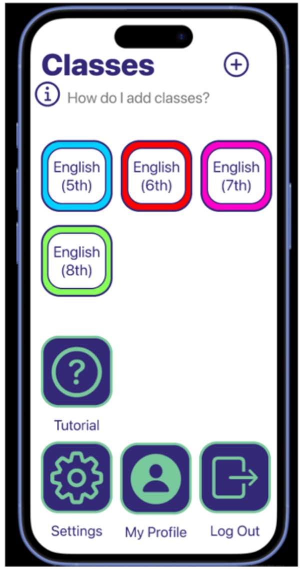
Changes

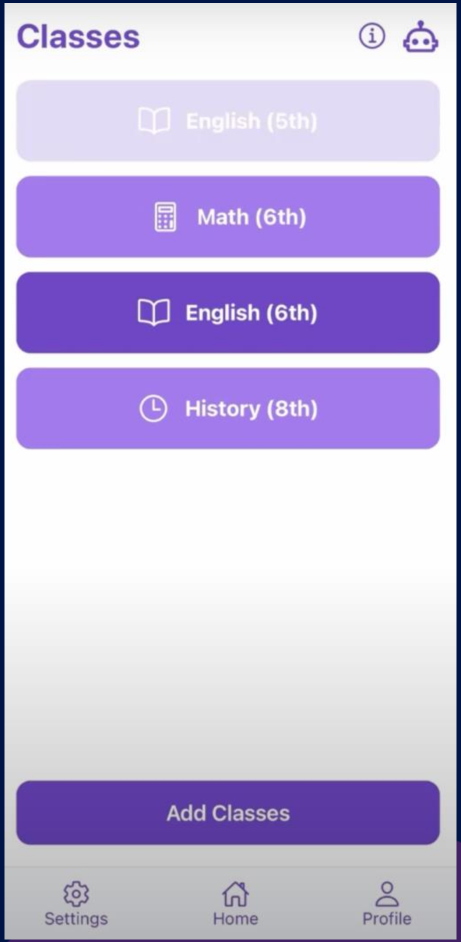
- Redesigned to mimic feel of other pages (& phone home screens)
- Added buttons for Tutorial, Settings, Profile, & Log Out
- Removed gradients for readability
- Added tooltip for info box

Justifications

- The redesign mimics familiar interfaces for a seamless experience.
- Adding buttons for key actions enhances navigation, while removing gradients improves readability
- Tooltips provide clear context for information boxes.

After

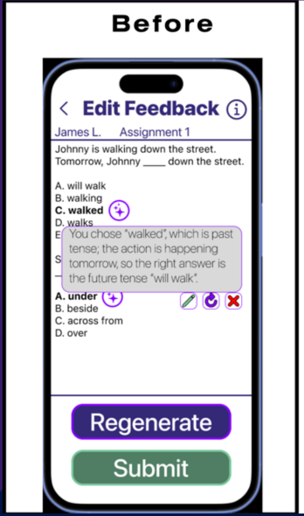




Mid -> Hi-Fi

Heuristic Violations and Fixes

Before



Edit Feedback

James L. Assignment 1

Johnny is walking down the street.
Tomorrow, Johnny ____ down the street.

A. will walk
B. walking
C. walked
D. walks

You chose "walked", which is past tense; the action is happening tomorrow, so the right answer is the future tense "will walk".

A. under
B. beside
C. across from
D. over

Edit Feedback (Editing)

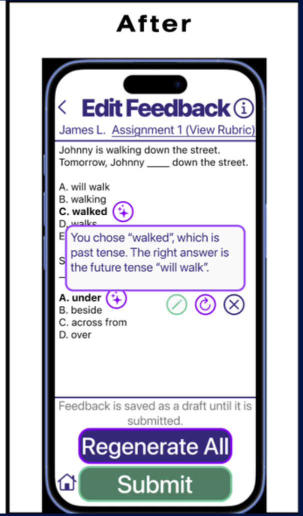
Changes

- Greatly increased contrast and readability for info text
- Altered design and color scheme for action buttons, increasing consistency with other UI elements and readability

Justifications

- Increasing contrast for info text improves legibility, making important details easier to read.
- Altering the design and color scheme of action buttons ensures visual consistency across the UI.

After



Edit Feedback

James L. Assignment 1 (View Rubric)

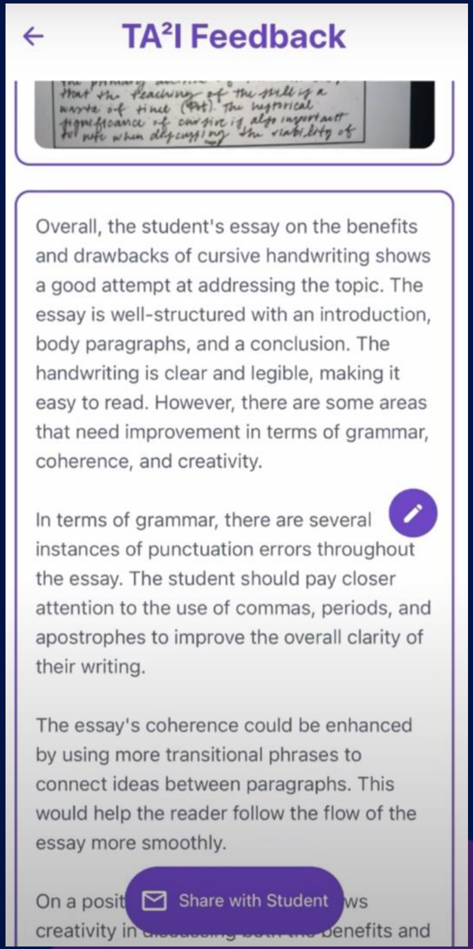
Johnny is walking down the street.
Tomorrow, Johnny ____ down the street.

A. will walk
B. walking
C. walked
D. walks

You chose "walked", which is past tense. The right answer is the future tense "will walk".

A. under
B. beside
C. across from
D. over

Feedback is saved as a draft until it is submitted.



TA²I Feedback

that the teaching of the skill is a waste of time (Pet). The historical significance of cursive is also important ... when discussing the viability of

Overall, the student's essay on the benefits and drawbacks of cursive handwriting shows a good attempt at addressing the topic. The essay is well-structured with an introduction, body paragraphs, and a conclusion. The handwriting is clear and legible, making it easy to read. However, there are some areas that need improvement in terms of grammar, coherence, and creativity.

In terms of grammar, there are several instances of punctuation errors throughout the essay. The student should pay closer attention to the use of commas, periods, and apostrophes to improve the overall clarity of their writing.

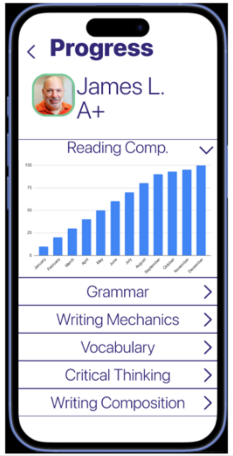
The essay's coherence could be enhanced by using more transitional phrases to connect ideas between paragraphs. This would help the reader follow the flow of the essay more smoothly.

On a posit... ws creativity in ... benefits and

Mid -> Hi-Fi

Heuristic Violations and Fixes

Before



Progress

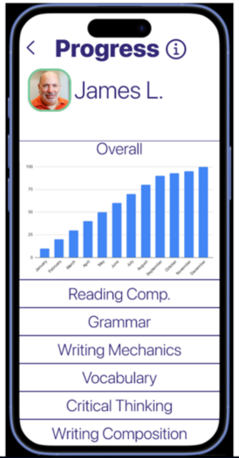
Changes

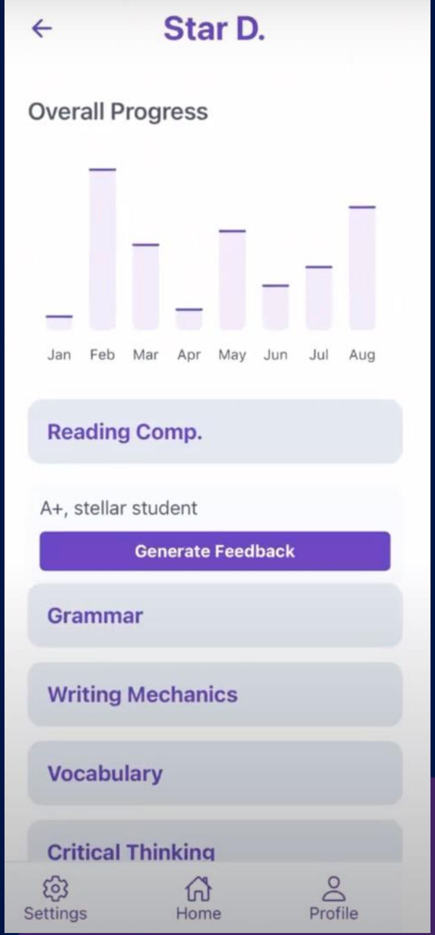
- Removed grade
- Added info box to explain functionality and data sourcing
- Added overall tab, which is now expanded by default
- Removed tap arrows for expansion, made boxes tap-able

Justifications

- Removing the grade simplifies the interface, focusing on key data.
- The info box clarifies functionality and data sourcing.
- The expanded default "overall" tab offers immediate access to key information.
- Making boxes tappable (instead of using arrows) enhances ease of navigation and streamlines the user experience.

After





Mid -> Hi-Fi

Values in Design

01

Fairness and Consistency

•**Features**: Rubrics must be uploaded before feedback is given to ensure standardized evaluations.

•**Explanation**: This ensures all students are assessed based on the same criteria, eliminating bias and maintaining uniformity in feedback.

•**Impact**: Provides equal and predictable evaluations, fostering trust in the process and making the grading system more

02

Efficiency and Timeliness

•**Features:** Immediate feedback is provided, with actionable insights visible to students.

•**Explanation:** Fast feedback allows students to make timely improvements and keeps the learning process dynamic.

•**Impact:** Enhances learning by offering quick, relevant feedback and streamlines the process for instructors. It also

03

Transparency and Accountability

•**Features:** Feedback visibility and an editing function ensure clear communication and accountability.

•**Explanation:** Students can see the rationale behind feedback, and both instructors and students can refine or clarify comments.

Impact: Promotes trust and engagement, encouraging a dialogue between students and

Addressing Value Tensions

Accountability vs. User Experience:

Detailed explanations can make feedback more accountable but may overwhelm students if they
receive too much detail.
→ Focused on providing key details & teacher is also encouraged to follow-up with the response given by the app & break down the feedback given at a later time if necessary.

Automation vs. Personalization:

Feedback may lack the personal touch that teachers add to evaluations. Students might feel the feedback
is impersonal or miss certain nuances that human feedback provides.
→ Focus of the app is to give feedback and hence, we prioritized automation for the functionality of the app. Teacher needs to work with the app to provide personalised / relatable feedback. Teacher should also be encouraged to follow-up on the feedback that is given.

Section 5

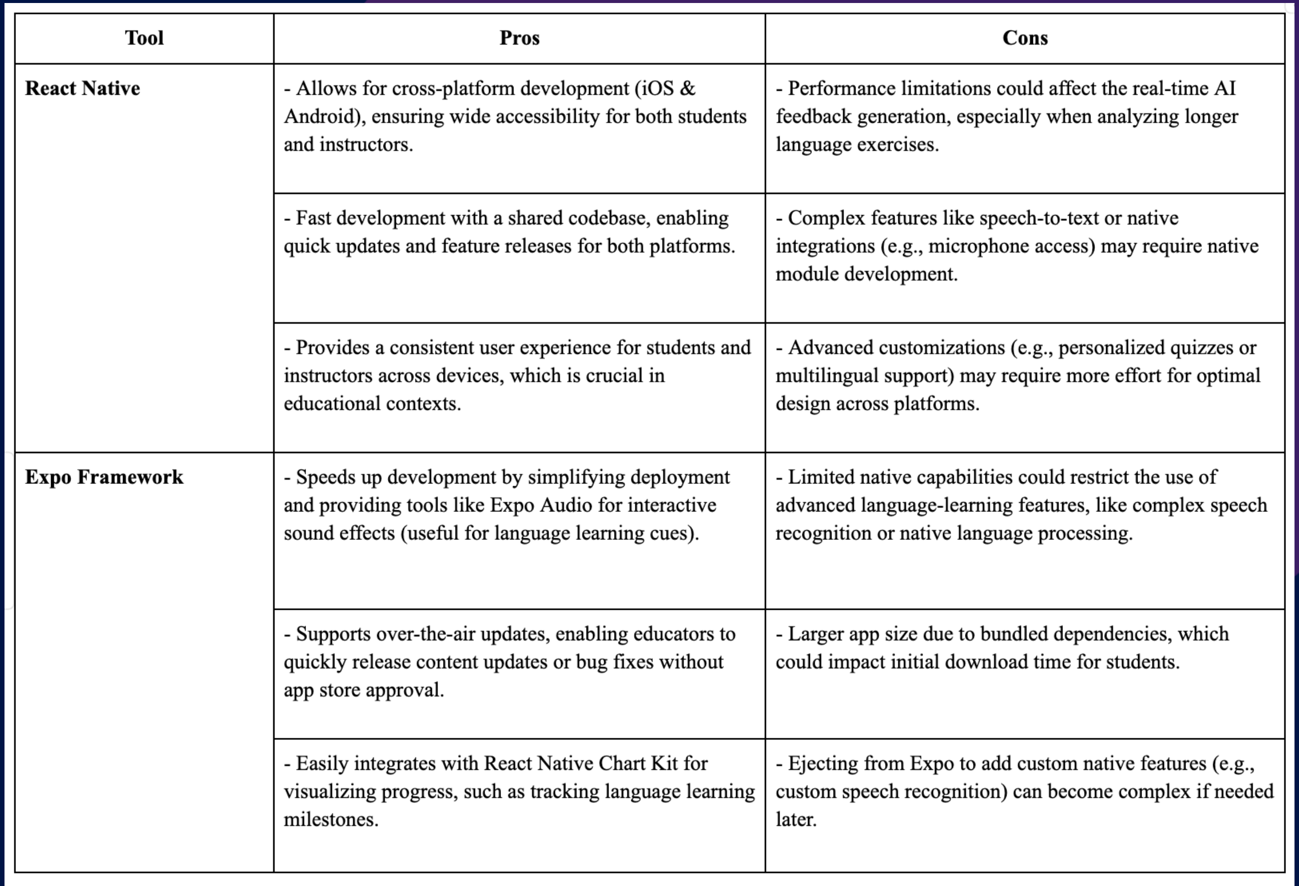
Final Prototype Implementation

Tools Used and Their Pros and Cons

The TA^{2}I app was built using React Native for cross-platform compatibility, with the Expo framework enabling rapid development and deployment for iOS and Android. The app uses OpenAI’s GPT models to generate AI-powered feedback on student submissions, showcasing the potential of integrating AI to support educators. However, much of the app’s backend functionality was simulated using Wizard of Oz techniques. For example, student progress data, rubrics, and assignment details were hardcoded rather than dynamically retrieved, allowing us to focus on refining the user interface and user experience without building a fully functional backend. This approach helped us present the app as if it were fully operational, enabling us to gather feedback from users during early testing.

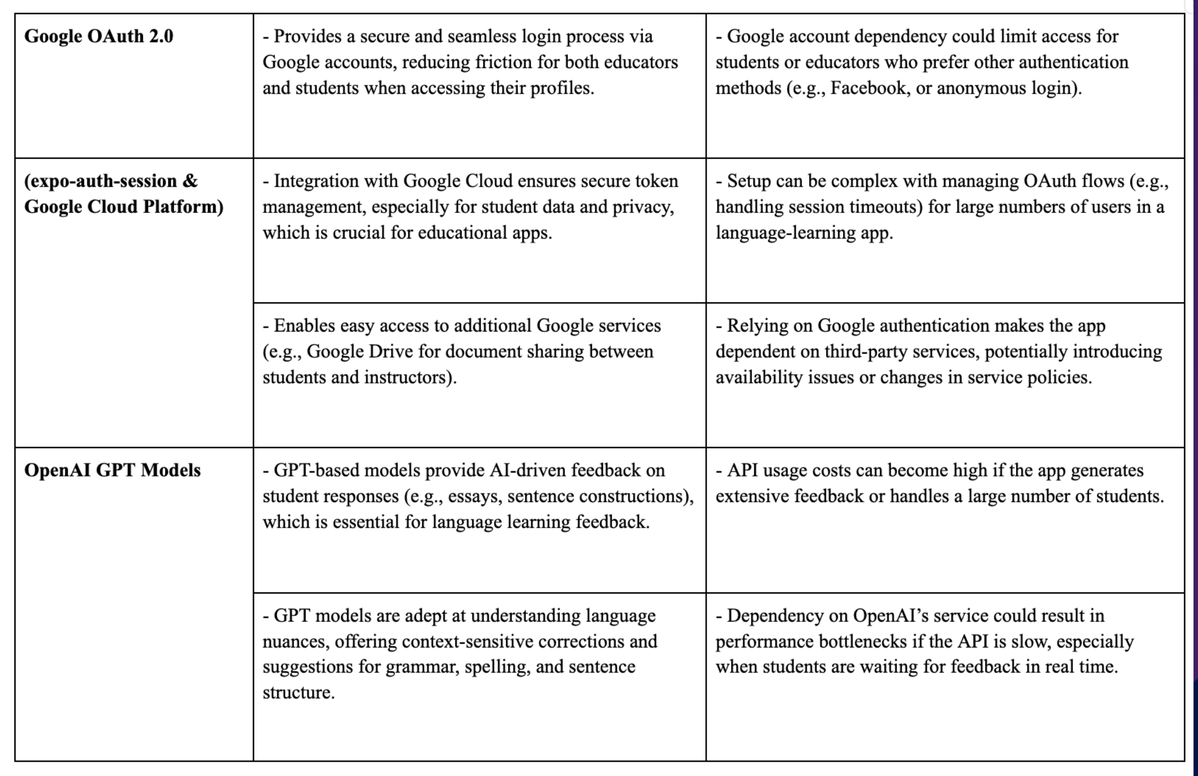
While the Wizard of Oz approach allowed us to move quickly and demonstrate the app’s key features, it also came with limitations. Hardcoding data restricted the app’s ability to scale or handle real-time interactions, and some features, such as Google OAuth for authentication, remained incomplete and non-functional. On the other hand, focusing on hardcoded data allowed us to prioritize the app’s design, flow, and the AI-driven feedback generation, which forms the core of its value. Tools like react-native-chart-kit helped us create visualizations for student progress, while React hooks ensured efficient state management. The reliance on Expo simplified development but introduced some constraints, such as limited flexibility for native module integrations. Overall, we were quite happy with the technical stack we chose as it allowed us to express our vision within the constraints of the class.

Tools Employed & Pros & Cons



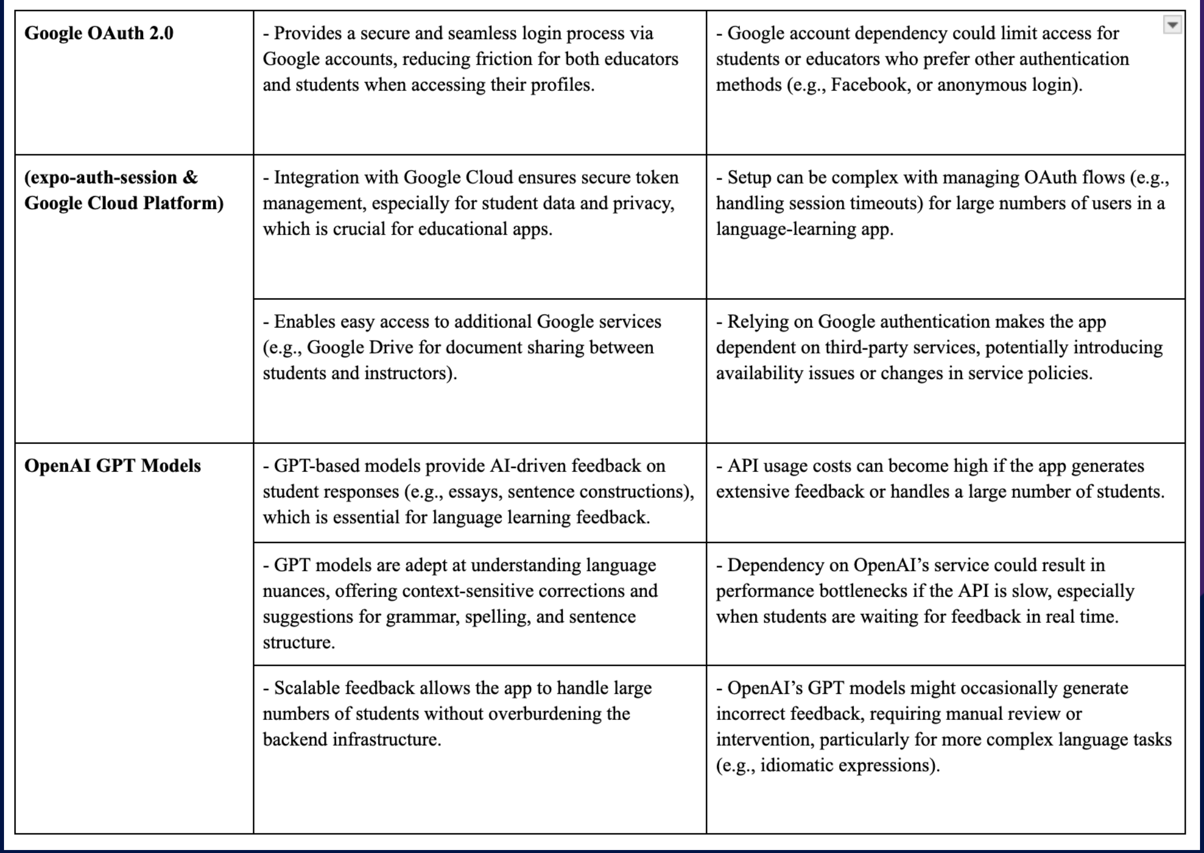
Tool	Pros	Cons
React Native	- Allows for cross-platform development (iOS & Android), ensuring wide accessibility for both students and instructors.	- Performance limitations could affect the real-time AI feedback generation, especially when analyzing longer language exercises.
	- Fast development with a shared codebase, enabling quick updates and feature releases for both platforms.	- Complex features like speech-to-text or native integrations (e.g., microphone access) may require native module development.
	- Provides a consistent user experience for students and instructors across devices, which is crucial in educational contexts.	- Advanced customizations (e.g., personalized quizzes or multilingual support) may require more effort for optimal design across platforms.
Expo Framework	- Speeds up development by simplifying deployment and providing tools like Expo Audio for interactive sound effects (useful for language learning cues).	- Limited native capabilities could restrict the use of advanced language-learning features, like complex speech recognition or native language processing.
	- Supports over-the-air updates, enabling educators to quickly release content updates or bug fixes without app store approval.	- Larger app size due to bundled dependencies, which could impact initial download time for students.
	- Easily integrates with React Native Chart Kit for visualizing progress, such as tracking language learning milestones.	- Ejecting from Expo to add custom native features (e.g., custom speech recognition) can become complex if needed later.

Tools Employed & Pros & Cons



Google OAuth 2.0	- Provides a secure and seamless login process via Google accounts, reducing friction for both educators and students when accessing their profiles.	- Google account dependency could limit access for students or educators who prefer other authentication methods (e.g., Facebook, or anonymous login).
(expo-auth-session & Google Cloud Platform)	- Integration with Google Cloud ensures secure token management, especially for student data and privacy, which is crucial for educational apps.	- Setup can be complex with managing OAuth flows (e.g., handling session timeouts) for large numbers of users in a language-learning app.
	- Enables easy access to additional Google services (e.g., Google Drive for document sharing between students and instructors).	- Relying on Google authentication makes the app dependent on third-party services, potentially introducing availability issues or changes in service policies.
OpenAI GPT Models	- GPT-based models provide AI-driven feedback on student responses (e.g., essays, sentence constructions), which is essential for language learning feedback.	- API usage costs can become high if the app generates extensive feedback or handles a large number of students.
	- GPT models are adept at understanding language nuances, offering context-sensitive corrections and suggestions for grammar, spelling, and sentence structure.	- Dependency on OpenAI's service could result in performance bottlenecks if the API is slow, especially when students are waiting for feedback in real time.

Tools Employed & Pros & Cons



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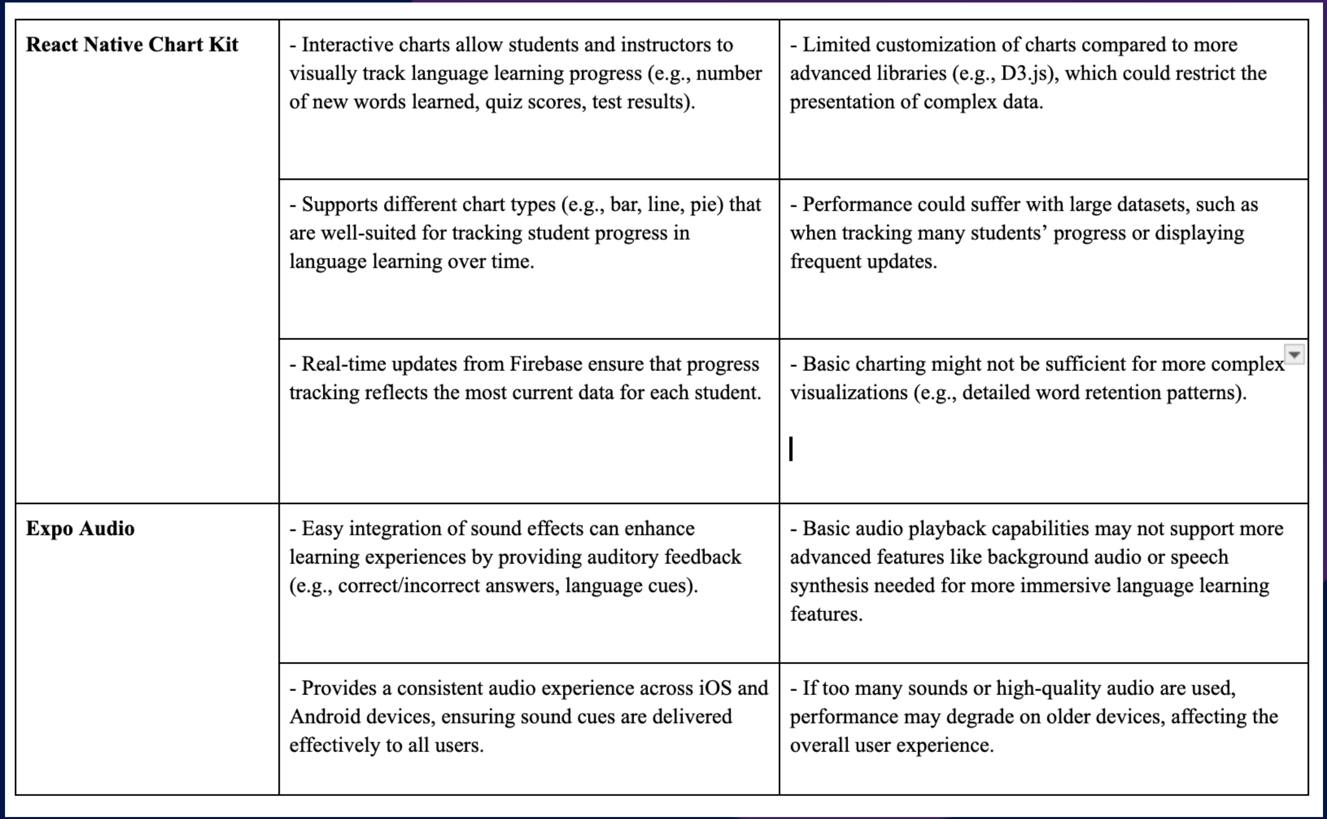
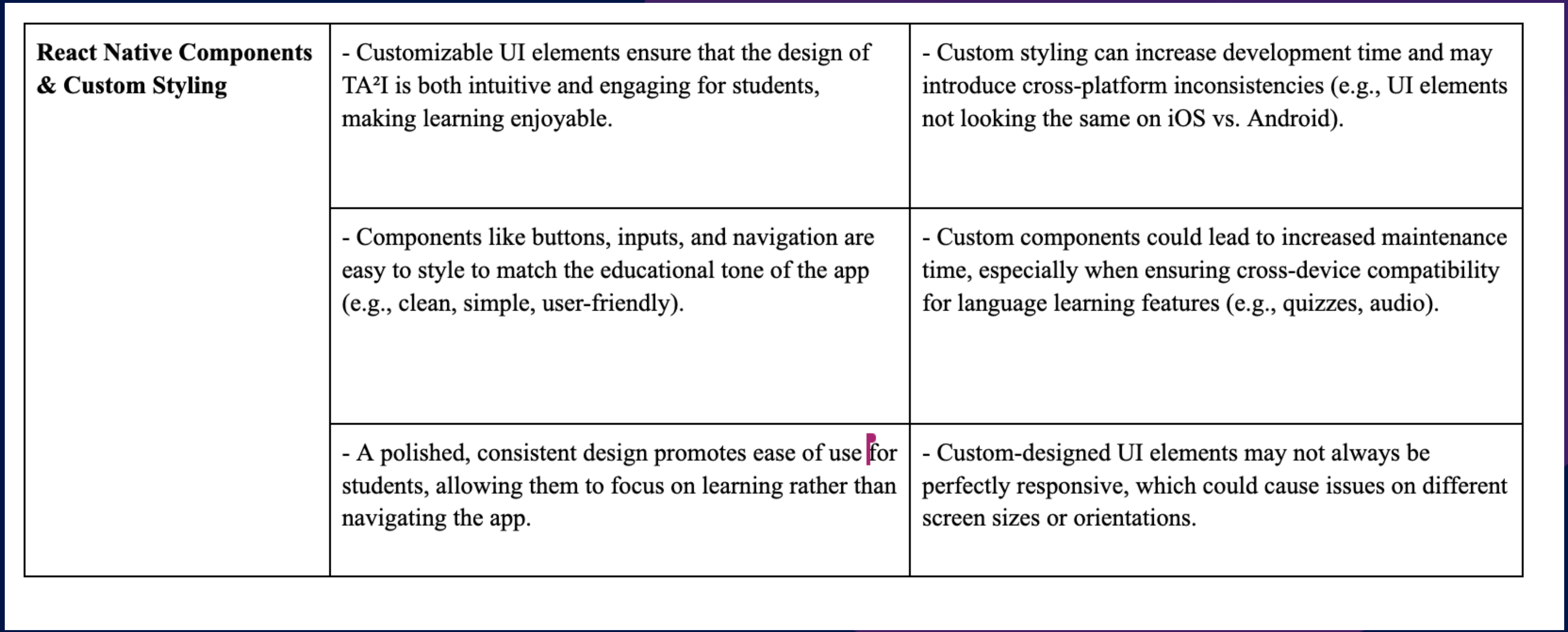
	- GPT models are adept at understanding language nuances, offering context-sensitive corrections and suggestions for grammar, spelling, and sentence structure.	- Dependency on OpenAI's service could result in performance bottlenecks if the API is slow, especially when students are waiting for feedback in real time.
	- Scalable feedback allows the app to handle large numbers of students without overburdening the backend infrastructure.	- OpenAI's GPT models might occasionally generate incorrect feedback, requiring manual review or intervention, particularly for more complex language tasks (e.g., idiomatic expressions).

Tools Employed & Pros & Cons



React Native Chart Kit	- Interactive charts allow students and instructors to visually track language learning progress (e.g., number of new words learned, quiz scores, test results).	- Limited customization of charts compared to more advanced libraries (e.g., D3.js), which could restrict the presentation of complex data.
	- Supports different chart types (e.g., bar, line, pie) that are well-suited for tracking student progress in language learning over time.	- Performance could suffer with large datasets, such as when tracking many students' progress or displaying frequent updates.
	- Real-time updates from Firebase ensure that progress tracking reflects the most current data for each student.	- Basic charting might not be sufficient for more complex visualizations (e.g., detailed word retention patterns).
Expo Audio	- Easy integration of sound effects can enhance learning experiences by providing auditory feedback (e.g., correct/incorrect answers, language cues).	- Basic audio playback capabilities may not support more advanced features like background audio or speech synthesis needed for more immersive language learning features.
	- Provides a consistent audio experience across iOS and Android devices, ensuring sound cues are delivered effectively to all users.	- If too many sounds or high-quality audio are used, performance may degrade on older devices, affecting the overall user experience.

Tools Employed & Pros & Cons



React Native Components & Custom Styling	- Customizable UI elements ensure that the design of TA^{2}I is both intuitive and engaging for students, making learning enjoyable.	- Custom styling can increase development time and may introduce cross-platform inconsistencies (e.g., UI elements not looking the same on iOS vs. Android).
	- Components like buttons, inputs, and navigation are easy to style to match the educational tone of the app (e.g., clean, simple, user-friendly).	- Custom components could lead to increased maintenance time, especially when ensuring cross-device compatibility for language learning features (e.g., quizzes, audio).
	- A polished, consistent design promotes ease of use for students, allowing them to focus on learning rather than navigating the app.	- Custom-designed UI elements may not always be perfectly responsive, which could cause issues on different screen sizes or orientations.

Section 6

Reflection & Next Steps

Main Learnings from the Design Thinking Process

Main Learnings: Iterative Feedback for Writing Improvement

Through the design thinking process, we recognized that language learners, especially in writing, need not just grammar corrections but also contextualized feedback. By conducting user testing, we learned that learners wanted explanations for corrections and examples to understand the rules better. This led us to implement real-time feedback on grammar, sentence structure, and word choice, with detailed explanations and alternative suggestions, helping learners improve both accuracy and style.

For example, one of the challenges we identified early on was that students often struggle with **grammar mistakes** that affect their overall writing clarity, but they also struggle to improve their **writing fluency**. They may know the rules but fail to apply them consistently. In response to this, we designed the app to provide **real-time grammar corrections** and **suggestions** as learners wrote, enabling them to fix mistakes immediately while understanding the rationale behind each correction. The **iterative nature** of the design thinking process became critical here: through **user testing**, we saw that learners wanted not just **grammar corrections**, but also **explanations** and **examples** to deepen their understanding. This insight led us to build out a more interactive feature where learners could click on grammar corrections to get additional explanations and see examples of correct usage in context.

Future Additions if More Time Were Available

Quiz Function Generator

Another feature we would add is a quiz generator that tailors quizzes based on the student’ s learning progress and areas that need improvement. This was something that we discussed but did not add into the app based on the scope of the project.

A quiz generator could be dynamic, adjusting to the student’ s performance on previous exercises or lessons. By offering personalized quizzes, the app would not only provide instant feedback on grammar and syntax but also test comprehension, vocabulary, and spoken language skills. A quiz generator would allow instructors to assign tailored content while maintaining a consistent feedback loop, ensuring that students are tested on concepts they are currently learning or struggling with. This would make learning even more engaging and targeted.

Offline Mode

Many students learn in environments with limited internet access, so developing an offline mode could ensure the app remains accessible at all times. Offline capabilities, like content caching for lessons, quizzes, and feedback, would allow students to continue learning even when a reliable internet connection is unavailable. This feature could be especially beneficial for students in rural or low-connectivity areas, ensuring that learning is not disrupted due to connectivity issues.