

EMIA2020
Cross-disciplinary Design Thinking
Fall Term 2023-2024

Group Project Final Report

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Background

As we formed a group of five, we have first identified that our common pursuits were about university teaching assistants (TA) and engineering faculty, so we have decided to perform field studies in Engineering Lab Sessions and interview a range of stakeholders. In this process, we have also determined that Postgraduate Engineering Teaching Assistants (PG TA) are our main target groups, with Undergraduate Students, Professors, and UG TA as other stakeholders.

Field Studies

We have performed 4 field studies in total



Figure 1: Photo of COMP 3511 lab, taken on 22nd Sept 2023

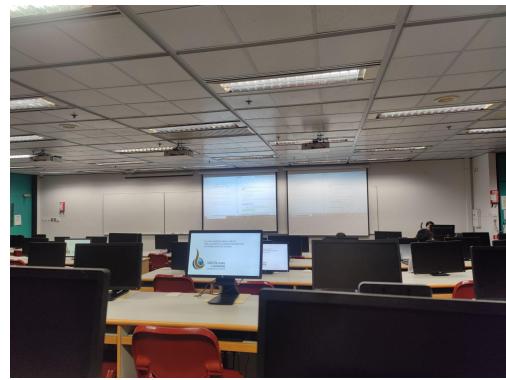


Figure 2: Photo of COMP 3111H lab, taken on 22nd Sept 2023



Figure 3: Photo of CIVL 2110 lab, taken on 27th Sept 2023

Index	TA/LI Name (FirstName and LastName)	TA/GI Cheering (FirstName and LastName)	Status
1			
2	Name: Li Chen Xu	Done: Li, Chung	DONE
3	Name: Ng Siu Fung	Done: ZHANG, Gongze	DONE
4	Name: Wan Ru Ka	Done: XU, Jian	DONE
5	Name: Wong Junyan	Done: ZHOU, Yuan	DONE
6	Name: SHI, Jingyan	Done: LEUNG, Wei Yan	DONE
7	Name: Tang Yiqi	Done: TIAN, Daigang	DONE
8	Name: WWA, Kwing	Done: YIN, Daigang	NF
9		YIN, Chung Xu Email:	
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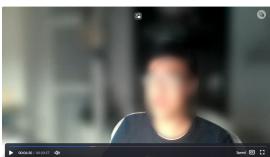
Figure 4: Screenshot of COMP 2011 Lab in Zoom, taken on 29th Sept 2023

Key Takeaways in Field Studies

From these field studies, we concluded that low student engagement rate and low teaching motivation were two major problems in PG TA's work. We therefore made the key assumption that teaching is the biggest challenge for PGTA. We aim to verify this assumption and observe other perspectives in our interviews.

Interviews

Alongside the field studies, we have interviewed 8 people in total, including 3 PG TA, a UG TA, 2 Professors and 2 UG students.

		 Stefan Chu	
Figure 5: Photo of interviewing EMIA PGTA in Zoom, taken on 18th Sept, 2023	Figure 6: Photo of CIVL PGTA interviewee, taken on 27th Sept, 2023	Figure 7: Avatar of CIVL PGTA interviewee	Figure 8: Screenshot of COMP UGTA interviewee in Zoom, taken on 29th Sept, 2023
		 Lucas Hui	 Jimmy
Figure 9: Photo of interviewing CSE Professor Desmond Choi, taken on 27th Sept 2023	Figure 10: Photo of EMIA Professor interviewee Rong Zhang	Figure 11: Avatar of UG interviewee Lucas Hui	Figure 12: Avatar of UG interviewee Jimmy

Key Takeaway from Interviews

There were many things, both expected and unexpected, which were found during the interviews. From the perspective of the non-students, it appeared that communication as well as time management between the different responsibilities of PG TA were the main problem continuously brought up. In particular, the fact that answering UG students' questions proved to be the most time-consuming for the PG TA while they struggle to juggle their other duties as well. This was further emphasized by the fact that from the UG students' interviews, it was found that they do value the chance to ask questions to TA, only not during in-class time which would further take up more time of the TA. As such, while the findings from the interview were multi-faceted, the crucial conclusion is that "Teaching is a challenge for some PG TA, but time management is a more significant and prevalent challenge."

Personas

Revolving around the field studies and interviews we have conducted, we have established the persona for each stakeholder:

 <p>Persona of Stefan Chu</p> <p>Bio</p> <p>Stefan Chu is a postgraduate student studying in civil engineering. He is also a TA in civil engineering course. He also studied for bachelor degree in civil engineering in HKUST.</p> <p>Age 20+ Gender Male Location Hong Kong Occupation PG student</p> <p>Academic Passionate Hard-working responsible attitude</p> <p><i>"I hope there's more engagement by students in class."</i></p> <p>Goal</p> <ul style="list-style-type: none"> - managing time more efficiently by balancing research and teaching duty - find a better way of answering questions to save more time - interact with students more during a class <p>Activity</p> <ul style="list-style-type: none"> - teaching in civil engineering tutorial sessions and answering questions inside and outside of class - spending most of his time on his PG research 	<p>EMIA2020 Cross-disciplinary Design thinking</p> <p>Goal</p> <ul style="list-style-type: none"> - having to answer questions in different platforms (email, WhatsApp etc.), which reduces time to focus on research - sacrificing his sleep to fulfill the responsibilities <p>Pain Points</p>	<p>Figure 13: Persona for PG TA (user)</p>
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 <p>Persona of Professor Chan (Professor)</p> <p>Bio</p> <p>Professor Chan is currently at professor of Computer Engineering education. He is from the department of computer science and engineering in HKUST, where he obtained his bachelor's and master's degree.</p> <p>Later on, he obtained his PhD degree abroad. He has supervised about 30 postgraduate teaching assistants so far.</p> <p>Age 40 Gender Male Location Hong Kong Occupation Professor</p> <p>Patient Talkative Humorous Hardworking</p> <p><i>"They also need to spend more time on designing the assignment, coming up with good idea, writing up descriptions, etc."</i></p> <p>Goal</p> <ol style="list-style-type: none"> 1) Solve problems raised by UG and PG students 2) Help UG students understand concepts better and PG students with their research 3) Assist TAs to teaching interestingly 4) Offer best learning experiences <p>Activity</p> <ol style="list-style-type: none"> 1) Teaching COMP lectures 2) Supervising PG TAs 3) Holding office hours 4) Answering questions raised by UGs 5) Holding meetings with TAs 	<p>EMIA2020 Cross-disciplinary Design thinking</p> <p>Goal</p> <ol style="list-style-type: none"> 1) Time management could be a difficulty with both PG and UG students to communicate 2) Interacting with many PG TAs supervised by other Professors can be tricky since other Professors can have different expectations <p>Pain Points</p>	<p>Figure 14: Persona for Professors (stakeholder)</p>
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 <p>Persona of Michael (Undergraduate TA)</p> <p>Bio</p> <p>As an Undergraduate TA, Darren attends to his responsibilities as an Undergraduate TA for COMP 2011 while at the same time following his classes.</p> <p>He is a very energetic individual, who seems to show a lot of interest and enthusiasm in regarding the things he do. He comes off as very sociable and conversational, and tries his best to look more towards the brighter side of things.</p> <p>Age 18+ Gender Male Location Hong Kong Occupation UG Student</p> <p>Enthusiastic Self-Dependent Interested in Teaching Conversational</p> <p><i>"I really like teaching... I mean, word-use scenario, it's still an experience"</i></p> <p>Goal</p> <ol style="list-style-type: none"> 1) Get more familiar with the flow of the tutorials (labs). 2) Find a good place to stay in during the tutorial (lab) Zoom meetings. 3) Answer students' questions during the lab to his utmost best of abilities. <p>Activity</p> <ol style="list-style-type: none"> 1) Helping out with COMP 2011 tutorials (labs): Answering questions and taking attendance. 2) Keeping up with his courses outside of his responsibilities as a UG-TA. 	<p>EMIA2020 Cross-disciplinary Design thinking</p> <p>Goal</p> <ol style="list-style-type: none"> 1) Having to go through all the different emails regarding his responsibilities as a TA, which comes off as very tedious. 2) Having to find a peaceful area to sit in during the Zoom meeting. 3) Students asking using the chat box, forcing him to continuously check by switching tabs. <p>Pain Points</p>	<p>Figure 15: Persona for UG TA (stakeholder)</p>
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Persona of

Lucas (UG student)

EMIA2020 Cross-disciplinary Design thinking

Bio	Goal
<p>Lucas is a year 2 student in ISDN. He is an independent and time-conscious person who prefers self-study over attending tutorials. He values his time and believes that engaging in productive tasks is more valuable than time-wasting things such as attending tutorials.</p> <p>Lucas is straightforward and honest in expressing his opinions during the interview. He is self-motivated and takes responsibility for his own learning.</p> <ul style="list-style-type: none"> -Independent -Time-conscious -Straightforward -Results-oriented 	<ul style="list-style-type: none"> -Meeting TAs with good teaching skills and engagement -Having supportive Materials provided in tutorials
Activity	Pain Points
<ul style="list-style-type: none"> -attending tutorials and labs held by UG & PG TAs -learn independently and explores online resources to broaden his knowledge 	<ul style="list-style-type: none"> -TAs do not interact with students effectively during tutorials -TAs have low motivation on teaching as there are no incentives for them to do so

Figure 16: Persona for UG students (user)

POV

Initially, we have decided that PG TA will be our target users. As we have diverged into 3 separate draft POVs about time management, questions from UG students and meetings with Professors, we have converged to a POV about answering UG students. As a result, we concluded that both PG TA and UG students are our target users. The below shows our iteration process.

03
Cracking through - POV and ideation

Assignment 3: Assignment 3:Cracking through - POV and ideation

Part1: POV & rationale
Each team selects one POV for your team's final project. Please elaborate concisely and clearly: why you select this POV, how you reach its final form, and the chains of evidence to support your decision.

Iteration Process

1. PG TA want to save more time on their major tasks (research) because answering students' questions can be time-consuming.

2. PG TA thinks that answering students' questions is time-consuming because they receive a large number of questions by UG students outside of class and these replies can be hard to track.

3. PG TA find these questions hard to track because there are multiple platforms (e.g. Outlook, WhatsApp, Telegram, Canvas, etc.) that UG students use to ask.

1

Figure 17: Iteration Process extracted from Assignment 3

With the above iteration process, we have identified the final POV, pain points for PG TA, and root causes of the existing problems.

PG TAs at HKUST face the challenge of efficiently addressing questions from UG Engineering students outside of class. PG TA's pain point is the time-consuming nature of answering student queries, which not only diverts the PG TAs' focus from their research but also leads to a reduction in their sleep time. This issue arises due to the existence of multiple platforms, such as Outlook, WhatsApp, Telegram, and Canvas, that students utilize to

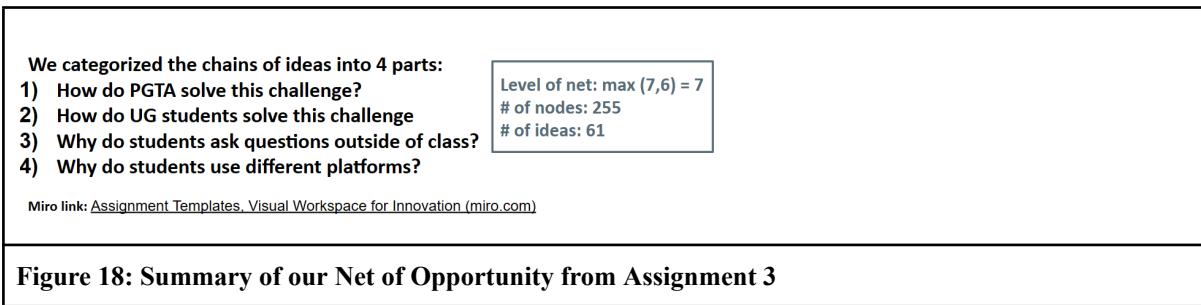
ask questions outside of office hours. As a result, PG TAs are required to navigate through these various platforms to respond to student inquiries, thereby creating an inefficient communication process. To address this challenge, we set our final POV as that PG TA in HKUST need to establish a streamlined system to conveniently answer questions by UG Engineering students into a single platform, enabling PG TAs to more effectively manage their time and provide more efficient support to UG Engineering students.

Net of Opportunity

The below Miro link is connected to our Net of Opportunity.

https://miro.com/app/board/uXjVMogTc_M=/?share_link_id=147369311075

The below is a brief summary of our net of opportunity:



The net was valuable in two aspects. First, it reveals that UG students have a strong tendency to ask outside class for multiple reasons, so we turned our attention to channeling outside-class questions into a convenient platform. For the second aspect, it assisted our discovery with the two major existing solutions, which are asking ChatGPT and asking TA in class. From analyzing the net, we decided that convenience and accuracy are two major elements in our POV.

Design Journey

Divergent Process

With the Net of Opportunity, we have also added our diverse ideas as potential solutions during our divergent process, highlighted in purple in Miro. We have then matched these ideas into an Impact-Novelty evaluation matrix, as shown below.

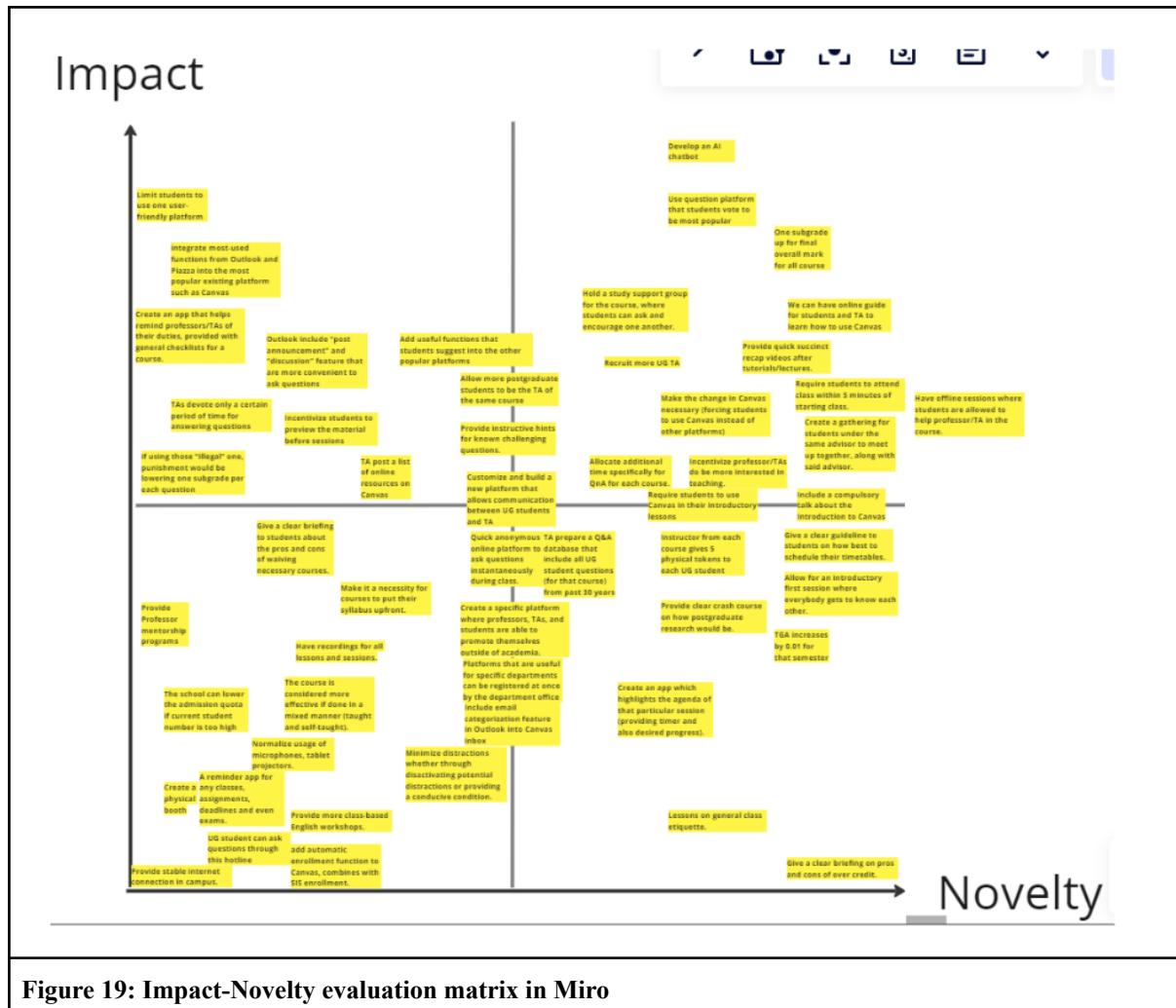


Figure 19: Impact-Novelty evaluation matrix in Miro

Convergent Process

From there, we also spent some time evaluating the common gaps of existing solutions as mentioned from the Net of Opportunity. The purpose of the convergent process was to narrow down the various ideas we had to those more related to these commonalities we wanted to tackle. As a result, we proposed three candidate ideas with these common gaps in mind.

1. Promoting the use of Canvas
2. Developing one new centralized platform
3. Incorporating ChatGPT with PG TA answering

<p style="text-align: right;">Assignment3: Assignment3:Cracking through - POV and ideation</p> <p>Part 4: Survey & analysis</p> <p>Conduct background research on existing solutions for this POV. Understand their strength and weakness. Do these solutions solve your POV? If not, why? What are missing? Please concisely summarize your findings and thoughts. This is to help you understand deeper the POV and to give you inspirations.</p> <p>Common Gaps of Existing Solutions:</p> <ol style="list-style-type: none"> 1. No incentives to use one single online questioning platform out-of-class 2. Low attendance and attention render in-class solutions ineffective 3. Solutions based on course materials do not provide room for further communication 4. Asking people apart from PG TA could receive inaccurate answers <p>Therefore, we need to incentivize UG Engineering students to use one single online questioning platform with participation of multiple stakeholders including PG TA.</p> <p style="text-align: center;">4</p>	<p>Figure 20: Common Gaps of Existing Solutions from Assignment 3</p>
<p style="text-align: right;">Assignment3: Assignment3:Cracking through - POV and ideation</p> <p>Part 4: Survey & analysis</p> <p>Conduct background research on existing solutions for this POV. Understand their strength and weakness. Do these solutions solve your POV? If not, why? What are missing? Please concisely summarize your findings and thoughts. This is to help you understand deeper the POV and to give you inspirations.</p> <p>Candidate Ideas:</p> <p>With the common gaps in mind, we think that these three ideas can bridge the gap between users' needs and existing solutions.</p> <ol style="list-style-type: none"> 1. Promoting use of Canvas (Canvas session/Canvas guide/rewarding scheme) 2. Developing one new centralized platform 3. Incorporating ChatGPT with PG TA answering <p style="text-align: center;">4</p>	<p>Figure 21: Three Candidate Ideas from Assignment 3</p>

Feedback from instructor and user testing

Having presented these ideas during class, we were able to get different feedback regarding the three ideas. There were a couple of interesting findings, partly inspired by our instructor. Firstly, we found out that most of the participants did not know of the functionalities of Canvas despite having used it for over a year or two. Second, ChatGPT was still not used by every participant in relation to their work, possibly due to the potential of inaccurate answers. Moreover, the feedback received regarding the first two ideas consistently highlighted a common concern. While these ideas addressed the immediate root causes we had identified, they did not effectively address the fundamental underlying problem: the necessity for a TA to answer students' questions in the first place.

This is where the third idea of incorporating ChatGPT became more prominent to us, and we spent more time trying to figure something out. It was then when we went back through the ideas we had during the **divergent process**, we came up with a way to combine ChatGPT with an FAQ/Q&A Database (idea shown near the center of Figure 19).

Alternative Designs:

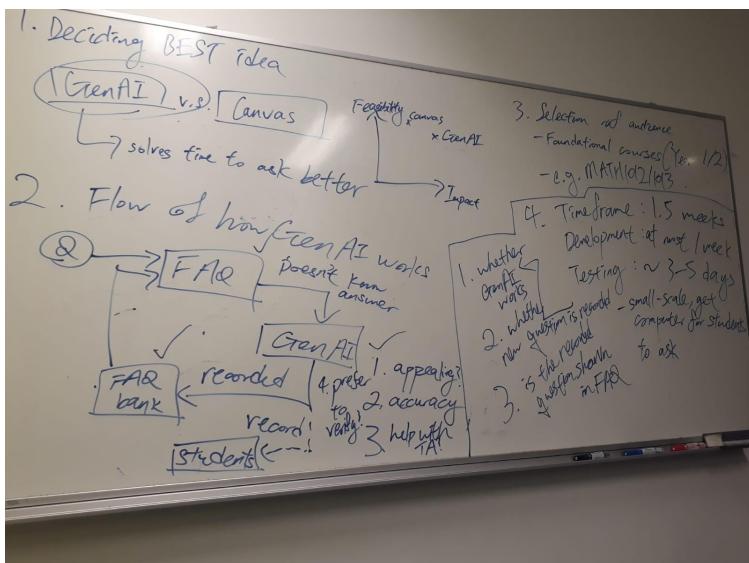


Figure 22: Meeting Minute on whiteboard, taken on 26th Oct, 2023

This meeting on 26th Oct, 2023 has recorded how we came to the final design of ChatGPT with an FAQ/Q&A Database. We have ultimately decided that ChatGPT is better at solving the main underlying problem of POV, and that the FAQ database can improve ChatGPT's existing gap of low accuracy. We have also determined the basic directions of prototype development and testing.

Project idea

We came up with a GenAI tool that is linked to an FAQ database, allowing students to refer their questions there instead of asking PG TA for most of their questions.

Target users

1. **PG TA:** They are the ones who answer many of the UG students' questions outside of lectures/tutorials.
Scenario for PG TA: Outside of office hours, when they are answering questions by UG students in online platforms
2. **UG Students:** They are the ones who ask the questions towards the PG TA outside of lectures/tutorials
Scenario for UG students: Outside of class time, studying for exams; working on assignments/revision

The unfulfilled needs of the target users

1. **PG TA:** They need to work on their researches but they don't have enough time to do so. This is because PG TA have many other tasks, with answering UG students' questions being one of the most time-consuming duties. Answering students is so time-consuming because there are many questions in different platforms, so there are both platform-switching time and time for answering questions. However, because there is no centralized platform and questions are not organized, PG TA are answering each question independently without an organized system. With the busy schedule, they need an efficient way to answer most students' questions without repeating themselves.
2. **UG Students:** They want to study for their exams conveniently and reliably but they currently can't do both. The two major ways UG students adopt to solve their questions are through asking GenAI and asking PG TA. However, the former method sometimes produces unreliable or even false answers which is problematic for preparing exams, while the latter one is limited to office hours and

deemed to be inconvenient by many. Currently, there are no easily accessible methods for UG students to get reliable assistance for exams conveniently, so they have a need for academic assistance which is both convenient and reliable.

As such, we then first identified the core functionalities we wanted to achieve based on the unmet needs and our brainstorming session.

The concepts we wanted to test

1. FAQ database which can be verified by PG TA
2. GenAI that are limited to only giving tips and assistance, but not direct answers
3. Summary of questions asked in GenAI for TA to update FAQ

We have also decided that the idea was to be named “T-AI”, as this combined both the concept of GenAI with the targeted PG TA we wanted to both help and allow our idea to be a substitute of.

Storyboards

With the concepts in mind, we have developed them into concrete features in storyboards, which served as our draft idea for the first prototype.

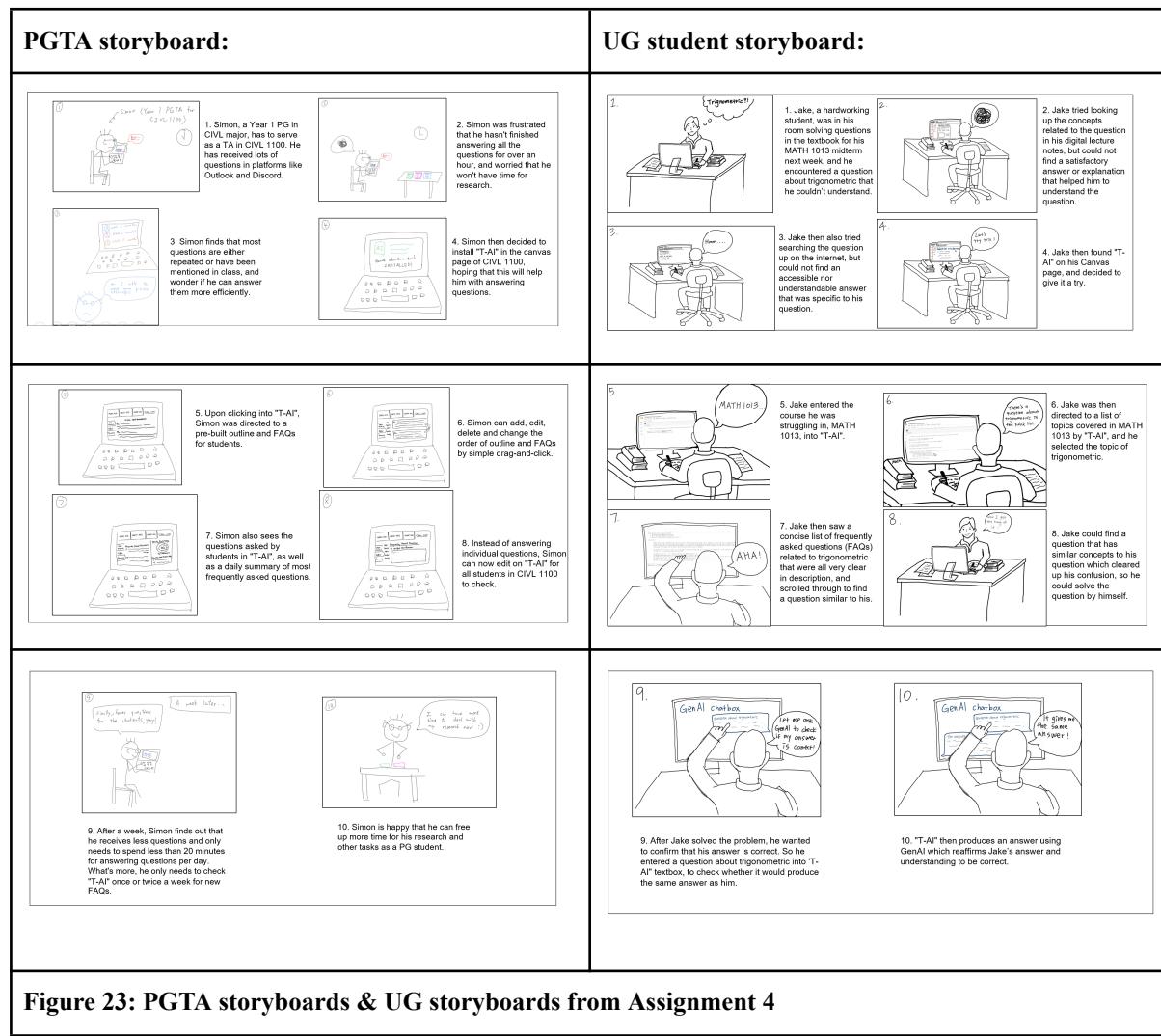


Figure 23: PGTA storyboards & UG storyboards from Assignment 4

Full sized storyboards can be viewed in Miro link
https://miro.com/app/board/uXjVMogTc_M=/?share_link_id=147369311075

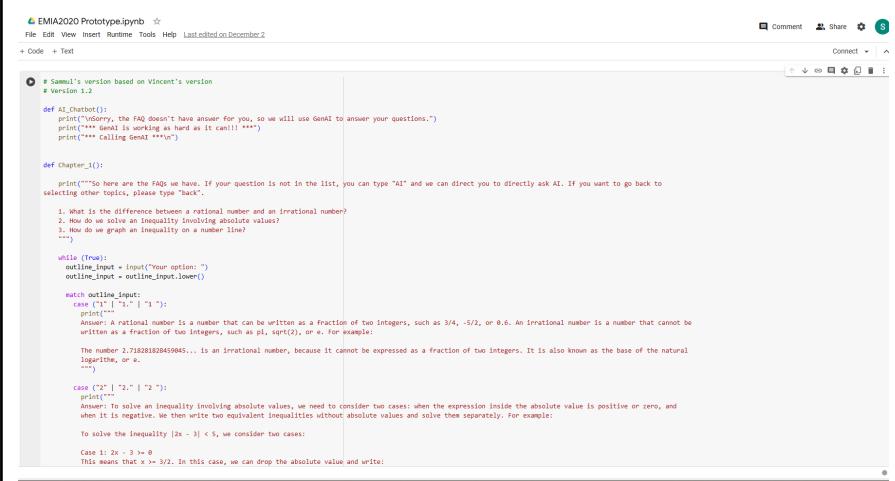
Prototyping Process & Test Process with Results

With the 3 iteration processes, we believe it is better to discuss the prototyping process and test results in each iteration. The three iterations are:

- Iteration 1: Python UI
- Iteration 2: Figma GUI for UG students
- Iteration 3: Figma GUI for UG students & PG TA + Functional Prototype on AskYourPDF

Iteration 1 (Python UI):

Based on our storyboard, we first aim to develop a hard-coded, “quick and dirty” Python program that simulates the user journey of UG students when using T-AI.



The screenshot shows a Jupyter Notebook cell containing Python code. The code defines a function `AI_chatbot()` that prints a message about using GenAI to answer questions. It then defines a `def chapter_1()` function that prints a list of three math-related questions. A `while` loop follows, prompting the user for input and matching it against three cases: '1', '2', or '3'. Each case includes a detailed explanation of what the user has typed and how the AI should respond. The code uses triple quotes for multi-line strings and includes several print statements to provide context and examples.

Figure 24: Screenshot of the Python prototype development source code

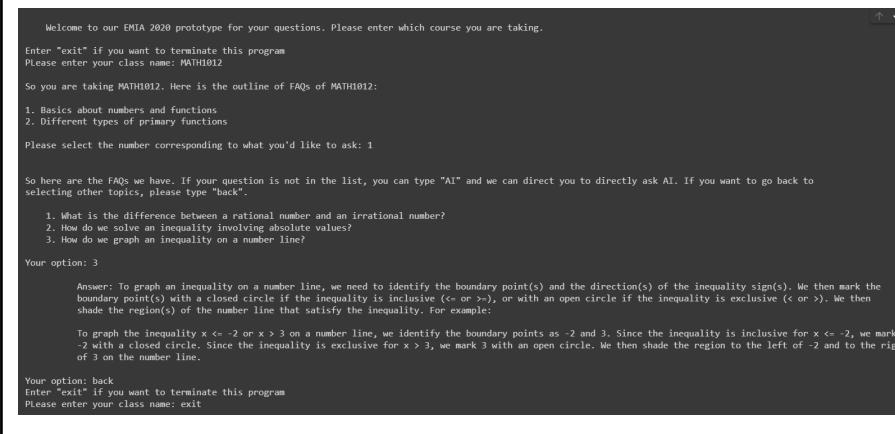


Figure 25: Screenshot of the Python prototype flow

Results of Iteration 1:

After interviewing 4 UG students and a PG TA, we have concluded their feedback into a matrix of test findings:

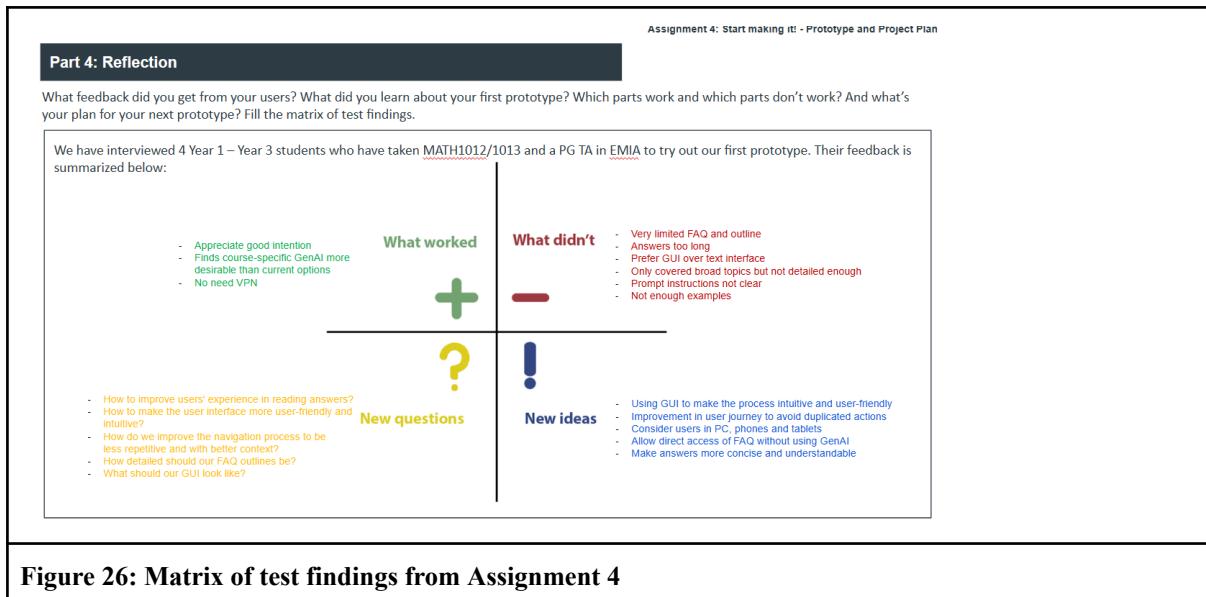


Figure 26: Matrix of test findings from Assignment 4

Iteration 2 (Figma GUI for UG students):

Based on the feedback from Iteration 1, we identify that the logical process is desirable, but it is not intuitive in text form. Not only do most of the participants reflect a desire for graphical user interface (GUI), most if not all new questions and ideas can also be responded to by developing a GUI. We therefore choose to develop GUI in Figma, first the conceptual prototype, then the appearance and functional prototype.

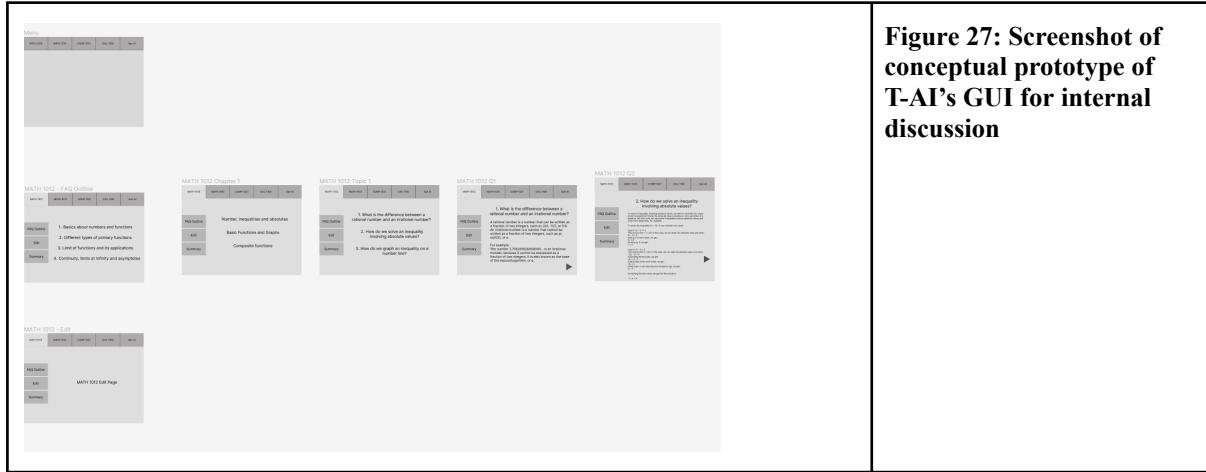


Figure 28: Screenshot of appearance prototype of T-AI's GUI for internal discussion

Figure 29: Screenshot of functional prototype of T-AI's GUI for prototype testing

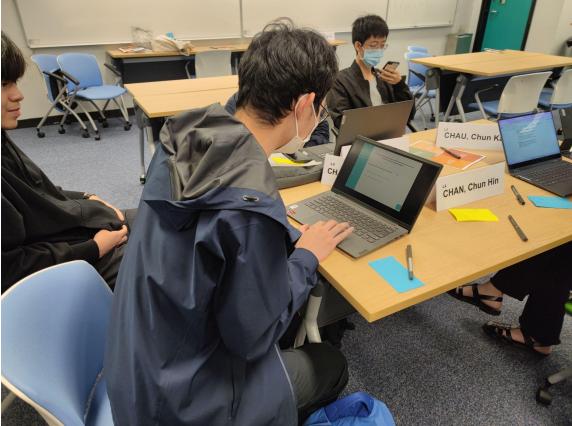
Results of Iteration 2:

After interviewing 3 UG students, a PG TA outside class, and 3 more UG students and a Professor in class, we have concluded their feedback into a matrix of test findings:

		What worked	What didn't	
		+	-	
		New questions	New ideas	
	<ul style="list-style-type: none"> -Simple intuitive UI designs -General concept is appreciated -Question history feature is useful -Easy to use for new users 		<ul style="list-style-type: none"> -Main Menu not navigated -Questions in FAQ not enough detailed -Need to look through all questions to see if the question is in the list -Basic answers may not help with actual troubles -Wordy answers -ChatGPT button is not intuitive 	
	<ul style="list-style-type: none"> -How to make the ChatGPT button more intuitive? -How to attract students to ask the GenAI instead of asking TAs? -How to implement the search feature? -How to make the FAQ answers better? 	New questions	New ideas	<ul style="list-style-type: none"> -New features: Thumbs-up/thumbs-down;Star/Favourited;Go back to;Save -Include input/comment section -Toggle views and rating for common question tab -A menu attached to the ChatGPT button -A Search bar -A brief description on each course -A note about concepts in each topic

Figure 30: Matrix of test findings for Iteration 2

Attached are some photos during the testing:

	
Figure 31: Photo of UG student from team 4 testing our prototype, taken on 21st Nov, 2023	Figure 32: Photo of UG student from team 3 testing our prototype, taken on 21st Nov, 2023
	
Figure 33: Photo of UG student from team 1 testing our prototype, taken on 21st Nov, 2023	Figure 34: Photo of Professor Zhang Rong testing our prototype, taken on 21st Nov, 2023

Iteration 3 (Figma GUI for UG students & PG TA + Functional Prototype on AskYourPDF):

The Figma GUI is reflected to be more intuitive and good looking, but there still lacks some important features for UG students to use for studying: saving favorite questions, comment section and self-test questions. Also, students reflected that the questions are not detailed and hard to locate. Moreover, Professor Zhang suggests that we should include statistics in questions and make the GenAI functional for tests. We have therefore included these features, designed an appearance prototype of PG and a functional prototype of GenAI.

Figure 35: Screenshot of saving favorite question feature

Figure 36: Screenshot of comment section feature

Figure 37: Screenshot of statistics of FAQs feature

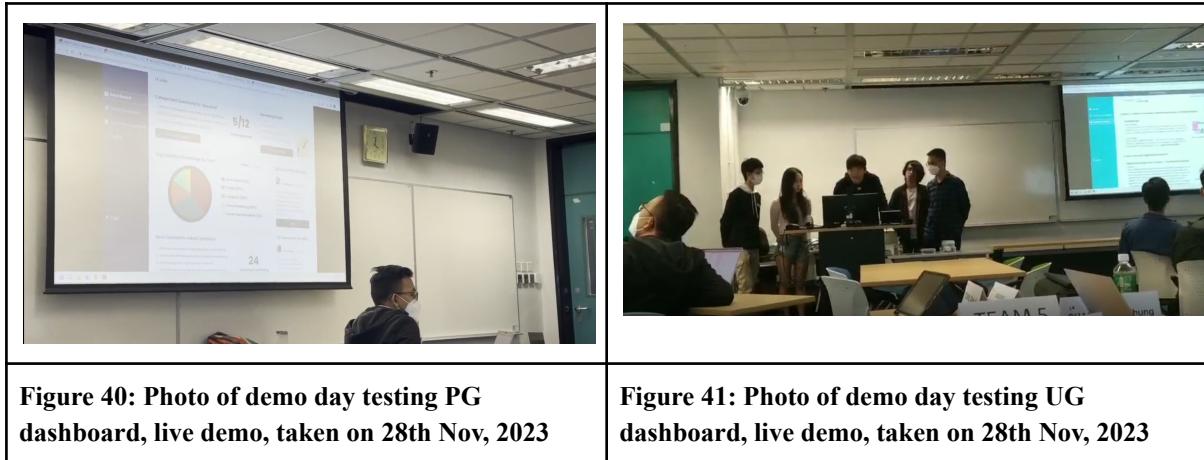
Figure 38: Screenshot of PG TA version appearance prototype

Figure 39: Screenshot of functional prototype of GenAI by AskYourPDF

Results of Iteration 3:

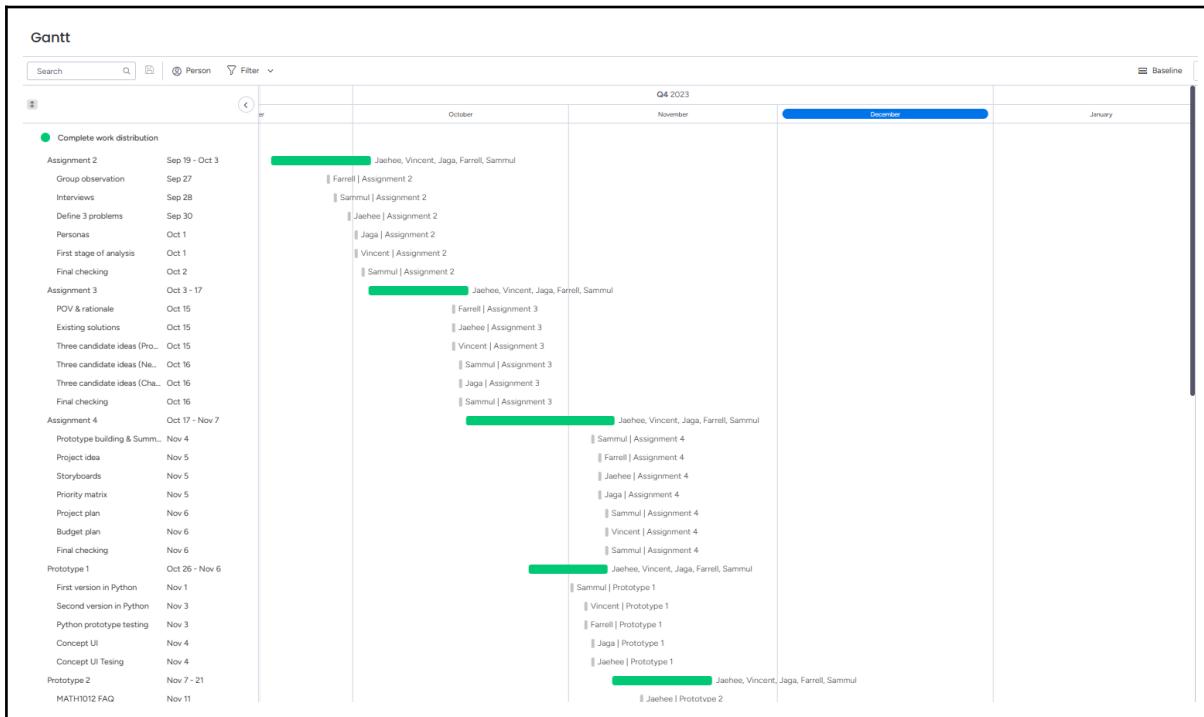
Due to the limitation of class schedule, we have only done our testing and collected feedback in our demo day. The class appreciated that there is a functional prototype of GenAI, but that a website is more preferred and a search bar function could increase the desirability of T-AI for locating a question easily.

Attached are some photos during the testing:



Gantt Chart & Work Distribution

Throughout the project, we have divided our work and recorded it in a Gantt chart and a work distribution table:



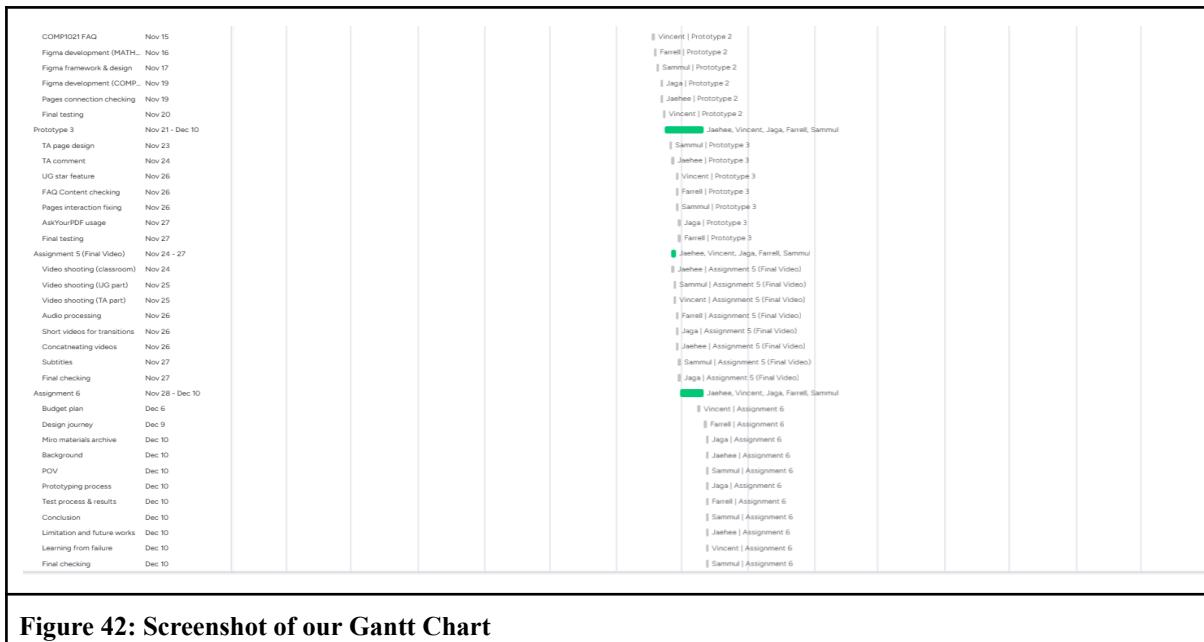


Figure 42: Screenshot of our Gantt Chart

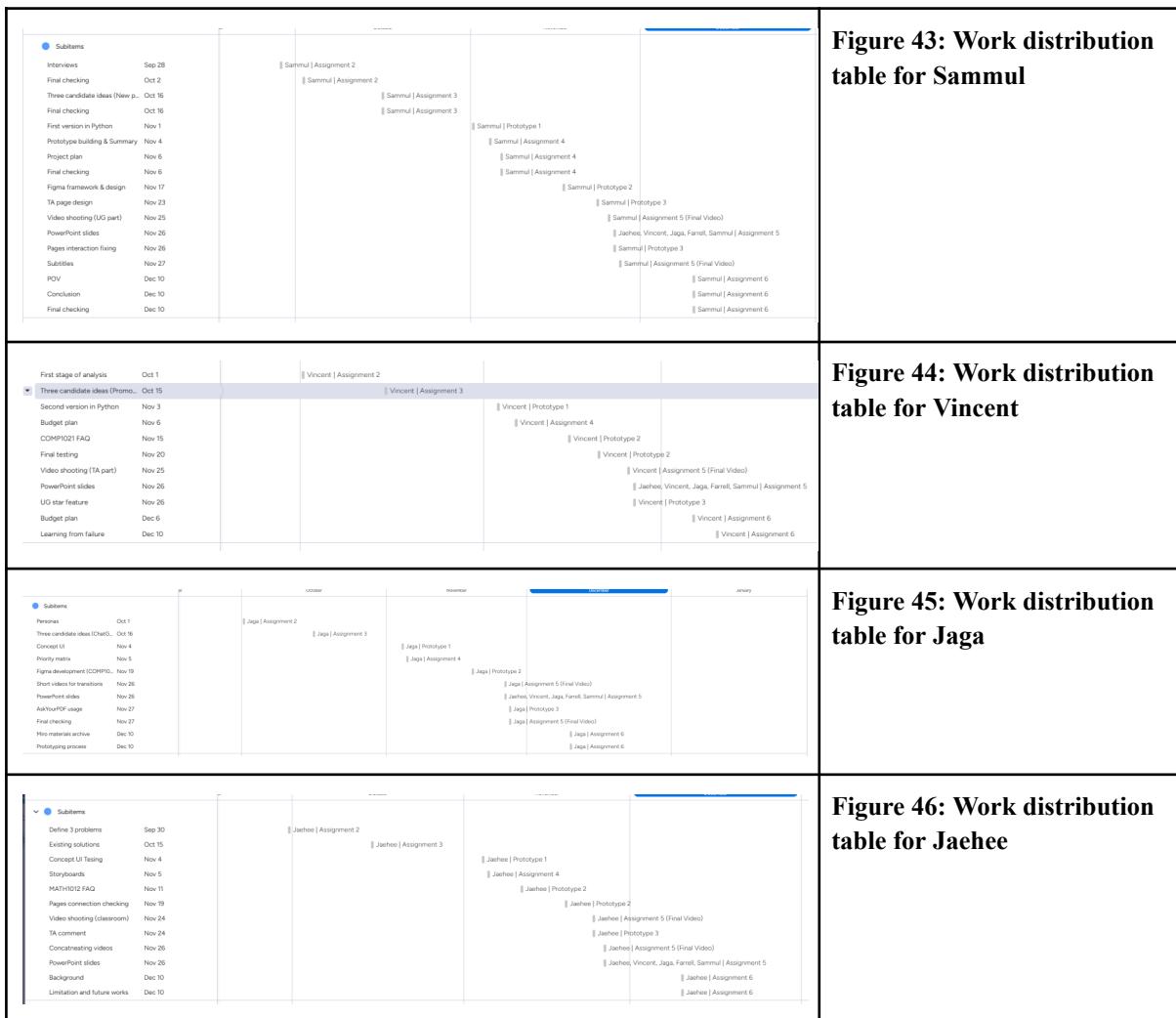


Figure 43: Work distribution table for Sammul

Figure 44: Work distribution table for Vincent

Figure 45: Work distribution table for Jaga

Figure 46: Work distribution table for Jaehée

Subsystems	Start Date	End Date	Owner	Description
Group observation	Sep 27			
POV & rationale	Oct 15			
Python prototype testing	Nov 3			
Project idea	Nov 5			
Figma development (MATH1012/3)	Nov 16			
Audio processing	Nov 26			
PowerPoint slides	Nov 26			
FAQ Content checking	Nov 26			
Final testing	Nov 27			
Design journey	Dec 9			
Test process & results	Dec 10			
Farrell Assignment 2				
Farrell Assignment 3				
Farrell Prototype 1				
Farrell Prototype 4				
Farrell Prototype 2				
Farrell Assignment 5 (Final Video)				
Jaehee, Vincent, Jaga, Farrell, Sammul Assignment 5				
Farrell Prototype 3				
Farrell Prototype 6				
Farrell Assignment 6				
Farrell Assignment 6				

Figure 47: Work distribution table for Farrell

Attached materials could be found in Miro:

(https://miro.com/app/board/uXjVMogTc_M=/?share_link_id=147369311075)

Through division of labor, we were responsible for tasks we were better at. Sammul helped with in-class presentations and prototype interviews with his business background. Since Vincent is majoring in Computer Science, he helps to prepare COMP1021 FAQs so that the errors occur in that FAQ can be minimized. Since Farrell majors in MATH+DMCA, he helped prepare the MATH1012/3 FAQs to be able to proofread the database we built as well as provide help with the project (product, video) design. Jaga is passionate about tasks related to UI & code development. Therefore, he mainly helped with the UI development in Figma. Finally, Jaehee helped preparing PHYS FAQs, interviews, and some design for storyboards and video since she has taken related courses.

Conclusion

From our main target group of PG TA and UG students, we discovered that PG TA does have a lot of other responsibilities outside of attending to students' questions. These different duties, including hour-long meetings with supervisors, commuting, doing research, make time management a much challenging task, potentially affecting the promptness of the TA's responses to the students' questions.

Throughout our iterative process and testing, we found that the concept of T-AI, despite not being a fully developed startup-ready product, presents an intriguing approach to address the challenges faced by PG TAs. Although there were limitations with the original Q&A database, such as the number of questions and topics covered, thoroughness of the responses, T-AI's functionality to expand its question bank through student interactions and input from PG TAs allows for gradual improvement with each use. The feedback from our peers, instructors, testers in regard to the idea itself were mostly positive, highly encouraging. This positive response implies that T-AI is an idea worth further exploration in the future, as it has the potential to address the challenges faced by PG TAs and enhance their effectiveness in supporting student learning.

Limitations and Future Works:

Based on the feedback from the interview with users and our own experience, we found some limitations that we could develop regarding the overall performance of the T-AI. The limitations are categorized in mainly 3 groups, which are user testing, functionality, and development limitations.

User testing limitations

To improve the evaluation process by user testing, it would have been advantageous to conduct more extensive user testing with a diverse range of students, as well as a diversity of courses and questions in T-AI. This approach would have provided a greater understanding of T-AI's viability and enabled us to assess the functionality and potential properties to be enhanced across diverse users. By expanding the testing to have a wider range of student users for the user testing, the prototype could serve its purpose on a broader scale, reaching a larger audience that shares similar challenges as our intended point of view. This broader testing approach would allow for a more comprehensive evaluation of T-AI's viability and effectiveness.

Functionality Limitations

Based on the feedback from user testing, there are several areas where T-AI could be improved to enhance its performance and better fulfill its intended purpose as a learning assistant. Firstly, to align with its original intent, expanding the range of available courses would have been more useful for a wide range of audience. In terms of chapter structure, breaking down the chapters into more specific and focused subtopics would enhance the organization and usability of T-AI. This approach would attract more users and better equip it to their specific learning needs, as an effective learning assistant. Addressing the feedback received about its contents, including a greater variety of frequently asked questions (FAQs) under each chapter. Additionally, increasing the number of examples within each concept would provide more comprehensive learning materials for users. Also, providing supplementary resources such as a graphical user interface (GUI) would facilitate the users' thorough understanding. The additional resources would offer alternative ways to present the academic contents, accommodating different users' preferences.

Development Limitations

During the semester, due to a short project period, there was a time limitation in transferring the T-AI prototype to a website form. To enhance the usability in different tools, developing a website of the prototype would be beneficial to increase its accessibility. As for its performance, while the T-AI prototype utilized a simulation process that effectively demonstrated the flow of usage to users, it encountered certain challenges during user testing, such as the need to restart the prototype simulation to perform various functions. The lack of smooth performance may have impacted the user experience and hindered gathering more accurate feedback.

Learning from Failure

Throughout the project, we have faced several failures and challenges along the way. However, we view these obstacles as valuable building blocks that have laid a solid foundation for preventing future failures and achieving success sooner.

For challenges within the project plan, we had not taken the initiatives to take photos in user and prototype interviews. This increased the difficulty in conveying that we have done authentic testing. We have also been too ambitious in both our prototyping timeframe and scope. Initially, we aimed to develop GenAI's UI with Bing's API as our first prototype, so that we can start from scratch to a fully functional website within a month as final deliverable. This turned out to be infeasible with the limited time and the lack of our expertise for developing GenAI softwares and websites.

As a solution for our infeasible plan, in our regular meetings we have reflected that we should start small and see what users want before further developments, and we turned to develop our "quick-and-dirty" first prototype in Python instead. Also, since a one-month period is relatively short for us to reach the goal of developing a website, we have discussed with TA to change our expectations to finishing functional prototypes for most of our concepts.

With these challenges we faced, we have learned the importance of setting realistic goals and time frames in project milestones, and open communication, regular evaluation of the process both internally and externally to keep it on the right track are also critical. With these learnings from failures, we will be better prepared for upcoming projects in the future.

Appendix

For all appendix such as interview scripts and prototype testing materials, we have included them in the Google drive and Miro for your reference:

Google drive: <https://drive.google.com/drive/folders/1MaxYUo6R6fLyoneyrtWhVtBu6ciWjzLe?usp=sharing>

Miro: https://miro.com/app/board/uXjVMogTc_M=/?share_link_id=147369311075