Problem Identification Report

Design Computing Studio 3 – Proposal

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1 Overview

Team AOM (Apple on the Windows) consists of six members, five from China and one from Malaysia. Upon the formation of the group, various intentions were discussed during the first few meetings in tackling different fields such as plastic wastage, water wastage, sleep, as well as education. After much pondering, education was ultimately chosen as the area of interest for the project. Exploring the education sector was relatively difficult due to education being a massive industry that is constantly in the process of innovation. Each member had differing opinions when choosing a specific problem zone within education and finally agreed to narrow the scope down to the possible problems of Chinese international students adapting to education at English-speaking universities.

This project aims to address the following inquiries: 1) The difficulty in understanding lecture content from overseas English-based universities; 2) class performance lacking in terms of activeness compared to local students; 3) a lack of self-confidence that could lead to psychological issues; and 4) the difficulty in taking notes while listening, resulting in the omission of important points while taking notes. The four issues discovered in this article were the primary impetus for investigating this domain. The AOM team conducted extensive research on the topic and identified four major issues within the problem space. Then, literature reviews were conducted to broaden the knowledge base on this issue.

The stated objective might not be to help international students improve their English but rather to help them study more efficiently. Although English is the top priority for international students, it may be difficult for newcomers to Western universities to learn English as a second language. Consequently, the programme may assist these students in bridging the gap in their knowledge, allowing them to adapt to the English learning environment and learn more effectively.

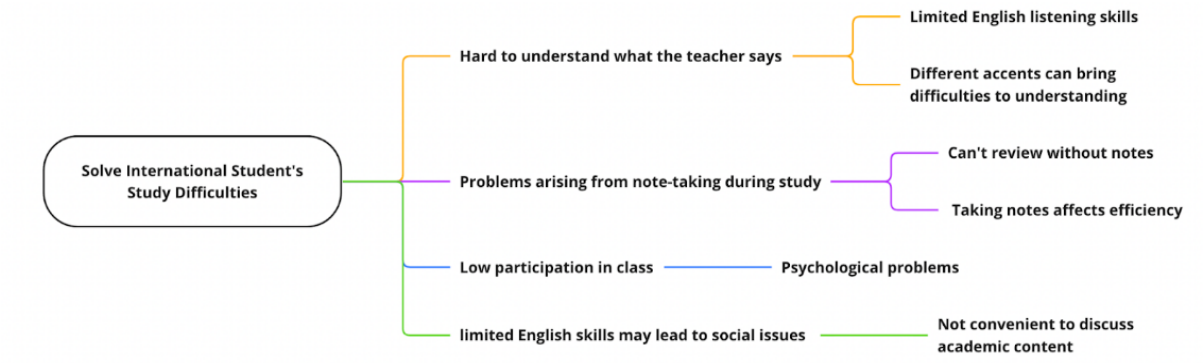


Figure 1 Brainstorming Progress

2 Literature Review

The purpose of the literature review is to demonstrate the validity of the four proposed core problems and the relevance of this research to the project. In addition, exhibit critical thinking in response to these requirements.

Firstly, non-native speakers having difficulty understanding lecture content would be a core problem. One of the non-native speaker team members stated that despite the fact that some pieces of knowledge were simpler to understand, the members could not fully comprehend the lecture. Furthermore, the specific member believes that the language barrier reduces study efficiency. Similarly, Heikinheimo and Shute (1986) argued that international students may struggle more than native English speakers to learn content in Canadian classrooms. The nature of the problem, according to the author, could be traced back to international students' lack of English proficiency. Furthermore, because of the language barrier, international students in Ukraine with poor Ukrainian language skills learn less effectively (Liudmyla, 2022). As a result, difficulty understanding lecture content due to a language barrier would be a common occurrence.

The second core problem is international students may be less engaged in class than native-speaker students. The following are the possible reasons. Firstly, international students might be afraid of making grammar mistakes when speaking English in class. This concern was also found in many international students from the DECO 7380 course. Besides, Jones (1990)

pointed out a situation where a small number of students got most of the interaction with the teacher in the classroom. Secondly, international students are less likely to understand different accents, whereas native speakers are less likely to misinterpret English with different accents (Carolyn & Joseph, 1985). International students who study abroad with students from different countries could very well face the challenge of understanding the accents of speakers from different countries. Besides, the number of silent students may be more than expected. According to Jones' (1994) research, 31.7% of students were identified as silent students (21 females and 11 males). This means that non-silent students initiated seven times more interactions with the instructor than silent students. Besides, the majority of silent students appear due to a lack of confidence and language barriers (Jones, 1994). Jones' article provides strong support for the need to improve non-native students' classroom participation. Thus, international students are less likely to participate in class.

Thirdly, international students' lack of self-confidence may lead to psychological problems. According to Myles and Cheng (2003), the challenges faced by international students are not only the language barrier, but also personal, social, psychological, and even academic challenges. Language barriers and cultural factors may reduce international students' self-confidence and even result in psychological problems if a healthy social environment is not created. Furthermore, Dovchin (2020) stated that students in Australia experience linguistic racism through racial accent bullying and language stereotyping, causing serious psychological problems. As a result, language barriers causing emotional harm are a common occurrence among international students. The design could be the solution to improving overseas studying and academic performance.

What's more, international students may have difficulty taking notes. Gur et al. (2013) demonstrated the importance of taking notes. Taking notes is not just about writing down materials, but also includes steps such as listening, comprehension, analysis, and selection. However, international students may not be able to effectively take notes in class because they could not fully understand the lecture content. International students may need more time to figure out which information is important to be noted down.

The previous review is based on the 4 core questions. The following review is based on the design purpose.

The design should consider the diversity of the target audience. Liz (2022) created a Disability Dongle concept. This concept satirizes the fact that many designers frequently ignore the needs of service users, making disabilities feel inferior when using these designs. The concept could be the project design's inspiration since part of the design process is similar to the Disability Dongle. The design is highly sensitive to the user group's negative impact on learning as a result of their low English proficiency. However, this consideration may result in some labelling or stereotyping. Liz's concept inspires the project to consider holistic solutions that will allow students to improve student's academic performance as well as their day-to-day interactions. Rather than focusing on the disadvantages that non-English speakers have over native English speakers. Furthermore, the member should consider the target audience's diversity demand broadly.

Finally, the education design direction is considered. One education white paper from the Queensland Department of Education (2018) indicates that the Queensland government will pay attention to increasing students' study participation. The government would have the plan to help young people engage in studying. Thus, a design to improve students' study attention and passion may be necessary and follow the education trend.

3 Stakeholders and Competitors

3.1 Stakeholders

This section entails the possible stakeholders that come with the problem domain we have decided to tackle. Since our area of interest is education, our stakeholders will most likely consist of students and student-related user groups.

The specific group of people this design is intended for is international students, specifically students who either don't have a good personal background in English or students whose home countries do not provide sufficient enough English curriculums to prepare them for their studies in English-based overseas education institutions. This group of stakeholders could be summarized as international students who do not possess good English skills from a practical standpoint.

The number of international students enrolling in English-speaking universities abroad as a result of COVID-19 may help to illustrate the vast size of the intended user base. According to Study in Australia (2023), approximately 750,000 international students were enrolled in Australian universities in 2022. Additionally, a study in Australia predicted that the number of international students would increase to approximately 940,000 by 2025. These figures are significantly higher than the number of students in 2021, which was only 570,000. According to Study in Australia (2023), Chinese students comprised the largest proportion of international students in Australia in 2022, with a total of 150 000. The sudden increase in the number and influx of Chinese students into Australian universities may be the result of a ban issued by the Chinese government. This prohibition prevented students from studying online and required them to attend classes on campus (Cassidy, 2023). Due to the fact that Australian universities resumed classes only a few weeks after the ban, Chinese students may be forced to travel to their respective university countries. (Cassidy, 2023).

Despite the fact that there are a large number of Chinese students in Australian universities, many of them speak English surprisingly well. According to Koymann (2018), despite China's No. 36 ranking on the EF English Proficiency Index, 99.9% of the population does not identify as English speakers, despite China's No. This is further supported by a study of Chinese students enrolled in U.S. universities, which found that despite their TOFEL scores, many international students from China had difficulty comprehending lectures, responding in class, and writing papers (Brown, 1998; Huang, 2004, 2005, & 2006, as cited in Jiang et al., 2017). Based on the aforementioned research points, there is once again a clearly defined user group that this solution can serve. Even though there is not a great deal of diversity among stakeholders, the sheer number of users that can potentially be served, combined with the rising number of international students, makes this an endeavour worth pursuing.

3.2 Competitors

In this part of the document, the possible competitors for the design solution are listed. These competitors also serve as a guide in terms of referencing what has been done, what can be done, and potential interesting avenues that have not yet been explored in the particular problem space.

3.2.1 Wordtune

Wordtune is the first competitor on the list of competitors. According to Software Advice (2023), Wordtune is an extension for the Google Chrome web browser that utilises AI and ML technologies to assist educational institutions, NGOs, and other businesses in rewriting their sentences to enhance written communication.

Figure 2 Wordtune Screenshot (Wordtune, 2023)

According to Raanan (2022), A121 Labs, a leading force in the industry of Natural Language Processing (NLP), developed Wordtune to modify the reading and writing practises of individuals. Wordtune offers a variety of methods for transforming somewhat dull text into clear, concise, and engaging content. A121 Labs developed its own AI model for Wordtune instead of relying on a third-party external model, as is typically the case with other businesses. According to Raanan (2022), Wordtune is also capable of translating the summarised text into numerous languages, including Spanish, Mandarin, Arabic, Hindi, and many others. WordTune utilises the freemium business model, offering the ability to translate, synonymize, and summarise text through various file formats such as PDF, DOC, etc. This program is mainly designed for businesses that require rewrites and enhancements to their written communication.

3.2.2 Scholarcy

Another known competitor in this market is Scholarcy. The service provided by Scholarcy is quite similar to Wordtune, but Scholarcy has a few interesting differences.

Figure 3 Scholarcy Interface (Scholarcy, 2023)

Scholarcy is a United Kingdom-based education technology company founded in 2019 by Emma Warren-Jones and Phil Gooch (Crunchbase, 2023). Scholarcy extracts key points from academic content via machine learning. According to Cruchbase (2023), students and researchers utilise Scholarly to substantiate their research paper findings and sources. In addition, Scholarcy also summarises articles, reports, and book chapters. The difference can be seen in the manner in which Scholarcy summarises content. Scholarcy displays its content through the use of digital flashcards. In addition, they convey the fact that they aid users in speed-reading their articles and quickly capturing the content's main points (Scholarcy, 2023).

Consequently, these rivals are primarily focused on enhancing the written communication skills of users by assisting them in condensing information into more concise points. In contrast, the issue we are attempting to address is how to improve international students understanding

of course material who do not have extensive English backgrounds. Consequently, it is still relatively safe to assert that there is a market opportunity to address this problem space, as it has not yet been directly addressed due to the lack of an exclusive product that targets the specific user groups identified in earlier sections.

4 Initial Conceptual Model

Based on the proposed problem, the Initial Conceptual model was built. As software that can help international students in need to increase their learning efficiency, the initial conceptual model is introduced in this section.

The software currently consists of three primary modules. The objective of the first module is to help international students improve their listening skills in class and provide a summary of key points. Through a recordable device, the software can record the lecture and convert the transcript in real-time. Students who struggle with English listening could review the text content transcribed by a machine to help them comprehend the missing keyword. After the lecture has concluded, the system would use AI models, such as ChatGPT, to synthesise documents based on the lecture recording and text. The document would facilitate a review and memorisation of the document's key contents. In addition, some minor features are intended to improve study efficiency and precision. The relevant materials could be uploaded to the lecture in order to facilitate previews, reviews, and the production of well-organized notes. Second, students can add an artificial mark to the note during the recording process. For instance, if the user believes that a particular point is crucial and must be included in the notes, a mark could be placed in front of the transcribed text. The system must then incorporate this portion into the subsequent note summarization procedure. Additionally, some instructors may have handwriting in the classroom. Students can take a photo of the teacher's notes, and the text or formula information will be extracted and added to the student's record.

The second module is the review module. Reviewing is important since Ebbinghaus (1913) mentioned humans would forget knowledge without reviewing regularly. The system will provide the key contents to the review module to facilitate review. Besides, students can also add additional content. In addition, the review module would automatically monitor the review

progress based on the Ebbinghaus forgetting curve (1913), allowing the student to retain the pertinent information.

The third module is questions and answers. In this module, users would be available to post questions. Artificial intelligence would respond to the query. If the user is not satisfied with the response, a human teacher will conduct additional research. Students may also choose to submit their question directly to a human teacher.

5 Sketching

In this section, we designed sketches of different pages and gave some introductions to related sketches.

Sketches	Explanation
	Main page： From this page, users could list class schedules and view class times. Users could also quickly review the recent recordings and notes.
	Review page: Based on the Ebbinghaus memory curve, we designed a function to remind users to review the main points regularly to ensure that they firmly remember the knowledge.

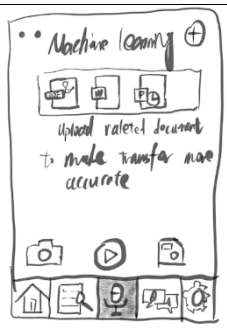
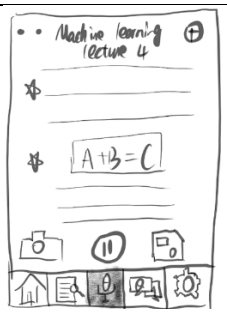
	Recording page: Before recording the lecture content, users can upload some relevant materials, such as lecture slides or some course-related books for model preview. This allows the app to take good dictation and take notes in a more organized way..
	Summary page： Based on the recording, the AI model can summarize and list all the important contents. Users could view and edit notes, and they could go back to the recording (which contains everything from the lecture) to add some content to the notes and make some corrections. Users could then save or export the notes to their IPad for viewing.
	Q&A page: On this page, users could ask some questions about a certain topic, and an artificial intelligence model will answer the questions. If users think that the artificial intelligence is wrong, they could also choose other users to help. After getting the answer the user wants, click the heart to save the question, and the system will let the user review the question on the review page for memorization.

Figure 4 Sketches Instruction

6 Areas of Investigation

The following point are showing the issues of the current design direction and some problems could not be addressed by the initial research:

- The extent to which the designed functionality addresses the target user's needs.
- Whether users will become dependent on using the app to acquire knowledge during use and thus slack off on learning.
- Ethical issues regarding AI access to audio and educational resources.

- Appropriate speech recognition technology.
- Location of data storage.

Some questions should be solved in the later project design progress:

- From the user's perspective

It is uncertain how to define the usefulness of our design concepts in terms of user use, and we have offered our thoughts on whether the application features lead to users learning to be lazy. For example,

- User involvement in the classroom may decrease.

Because users may believe that acquiring knowledge becomes simpler and, as a result, only return to the lesson content summarized in the software rather than taking the lesson seriously, they may fail to improve their English further.

- It may lead users to put off finishing their learning plans.

Users may develop mental sluggishness and believe that it is acceptable to learn later because the software has already stored all of the knowledge.

- From the designer's perspective

- More detailed user research.

The idea for our group’s project arose from the group’s experience and related dissertation research. There was a lack of research data on the needs of more international students regarding the quality of learning in the classroom.

- From the school's perspective

- Recording and photographing the software may result in copyright issues for teaching materials.

To address the issues raised above, we can reduce the risk in the following ways

1. We believe that our concerns about users relying too heavily on this application could perhaps be addressed by designing the necessary user interfaces and conducting appropriate user testing. For example,

- Set attention pop-ups during the software "lesson", e.g., ask the user every 25 minutes based on the text analysed ‘key words’ in the classroom → Ensure students' engagement and practice English listening skills.
- Better weekly review schedules and visualization of course completion → User control of learning progress helps reduce slackness.

2. For ethical considerations, we can look at the relevant rules and regulations and compare similar applications already on the market to find ways of using audio and teaching materials appropriately.

3. For further identification of user needs, we can organize some user interviews to determine whether the needs of the target users match our actual concept.

7 Project plan

When our group try to iterate the conceptual model in answering the questions we have defined, we can do so according to the following steps.

1) Gather user feedback and requirements to understand user perceptions and usage of the product.

2) Analyse user feedback and requirements to identify problem areas and propose solutions.

3) Design a new conceptual model, and test and evaluate it.

4) Make adjustments and optimizations based on the test results until the desired effect is achieved.

Iterative design is a crucial step in the interaction design process and an integral component of design optimisation. In our project, based on our defined problem of assisting international students with comprehension difficulties in a full English language environment, we first needed to create a low-fidelity prototype concept model and then iteratively test it through

research, such as giving the target user a short time to observe our design and then asking them what they remembered to ensure that the focus of our design interface met expectations. After completing the user testing, and based on the results of the user testing, we may be able to modify some design details and identify discrepancies between our initial vision and the actual situation regarding task flow, language, interface visuals, and key features.

To arrive at a final proposal for our project, we believe at least four steps are necessary. Constructing the concept and initial prototype, conducting in-depth user research and design, identifying key features and conducting user testing, and then optimising the model based on user feedback. Multiple cycles of user testing and iterations are possible.

In the first phase, we had already discussed and developed the design concept and conceptualized the initial prototype.

In the second phase, we need to conduct more in-depth background research and user interviews based on the prototype we wish to design to refine our target audience and understand the needs and expectations of the target users, to ensure that the core functionality of the application does provide tangible problem-solving capabilities for the target audience.

In the third phase, we will consider sorting out and differentiating the core and secondary features of the app and further refine the initial prototype design, shifting our attention more to designing the way we interact with the user and improving the logic of the app, for example trying to design an easy to use and navigate app interface so that users can easily record teaching content.

In the fourth phase, we will carry out a range of user tests and collect their feedback to ensure that it meets the needs and expectations of the users and that there are no usage scenarios that deviate significantly from the user's mental model. Based on the feedback, the prototype will be further optimized and finally, our work will be presented to you.

GREEN = DONE YELLOW = IN PROGRESS ORANGE = NOT STARTED

	Week 5	Week 6	Week 7	Week 8	Week 10	Week 11	Week 12	Week 13
Milestones	Problem identification	Submission of report	Further research	Interim Project Critique				Exhibit
General Tasks	Presentation: 1. Introduction of how we decide the domain. 2. Focus on the domain we chosen. • explains the problem space - done • background research - done • explore you have conducted so far for problem and solution spaces. 3. Designed directions - alternatives considered and justification. 4. Discussion of the risks. 5. Early prototyping. 6. Initial high level plan.	1. Overview 2. Background reading/literature review + More research 3. Stakeholders + Competitors 4. Initial Conceptual model 5. Questions/areas of investigation 6. Prototyping/sketching/mock-ups 7. Project plan 8. Submit a report	Further research					
Norman	Introduced the presentation	• Researched more into design opportunities • wrote the intro of the report	Further research					
Su	Focus on the domain we chosen. • explains the problem space - done • background research - done • explore you have conducted so far for problem and solution spaces.	Write half of the research section of this report	Further research					
Peilin	Focus on the domain we chosen. • explains the problem space - done • background research - done • explore you have conducted so far for problem and solution spaces.	• Background reading/literature review + More research • Conduct research on the problems listed and write in the report	Further research					
Yuhong	Conclude alternative direction. Manage slides style.	Help description of alternative direction; Generate report and help investigate	Further research					
Yuwei	Discussion of the risks of the project. How to mitigate them.	Gives a detailed description of the risks involved. Relevant technical considerations and concrete examples of risk reduction.	Further research					
Hongtai	Based on problems pointed out designing functions and early prototype of the product.	write Initial Conceptual model part of the report.	Further research					

Figure 5 Initial Project Plan

Here is the detailed project plan that our group is currently working on, where we have set broad goals for each phase and no one's breakdown of tasks.

Finally, we reflect on the risks inherent in the design process and ways to minimize them, including four aspects.

The following are the possible risks we have considered for the whole project implementation process.

1) Technical risk: The accuracy and stability of the speech recognition technology may affect the effectiveness of the use of the application.

2) Privacy risk: The application requires access to the user's microphone and storage device, which may reveal the user's private information.

3) Competition risk: Similar applications already exist in the market, which may affect the market share of the application.

4) User experience risk: The user interface and interaction of the application may need to be more user-friendly, which may affect the user experience.

To avoid or mitigate these risks, we may consider taking the following measures:

1) Choose a stable and accurate speech recognition technology that has been fully tested and optimized.

2) Protect user privacy, for example by clearly informing the user what information the app needs to access and ensuring that user information is not compromised

3) Design unique and attractive functions and features to attract more users

4) Design user interfaces and interactions that are friendly and easy to use to enhance the user experience.

8 Conclusion

In summary, our proposed solution focuses on improving international students' understanding of class content and even helping them summarize important knowledge. Therefore, international students who lack sufficient English skills are the target audience for our design projects and the number of such international students is expected to increase in the coming years, thereby creating a large potential user base for any solution in this problem area. As mentioned above, despite the presence of competitors in the market, there is still room in the market for products that specifically address the needs of this user group.

After the discussion and preliminary design of our project, we still believe that our design direction needs to be carefully considered and planned from the perspective of users, developers, and educational resources. Through careful planning, research and expert consultation, these issues can be addressed to ensure successful project implementation.

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