

2021 Spring Interaction Design

Final Paper

Redesign of Yonsei University LMS Application ‘Learnus’ UI/UX Design Based on In-Depth Research



Uni+ed

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Introduction

LearnUs is a *Learning Management System* (LMS) developed as a substitute for YSCEC, the former LMS of Yonsei University. YSCEC was a supportive system for face-to-face (F2F) lectures. However, since the strike of the global pandemic in 2020, the conventional classroom environment could no longer be considered as the first option for education due to the risk of mass infection. Therefore, the need for a service that fully supports the ‘untact’ lectures arose, and thus LearnUs was created. LearnUs succeeds most of the functions to YSCEC, and according to Yonsei Chunchu, the official university newsletter, LearnUs intends to target not only Yonsei University students but also both domestic and international students who need an online education platform. In addition, it also utilizes a cloud system, intended to make the use and share of data more efficient (Jeong, 2021). The main platform for LearnUs is PC, but also supports an adaptive interface to be used in mobile environments like tablets and smartphones.

Although the adaptive interface makes LearnUs able to be used on a mobile platform, it was not specifically designed for mobile devices, thus making the mobile interface of the service rather like an adjunct for the PC environment, not fully accommodating the needs of the users who want to utilize this LMS in their mobile devices. Therefore, we plan to design a mobile application for LearnUs, to aid Yonsei University students in enhancing their cross-platform learning environment. Along the way, we also addressed some of the negative feedback that LearnUs has received and hope to fix them.

The research has gone through the UI/UX critique of the current service, reviewed literature papers, and conducted a survey and interviews to gather information about the users’ experience with LearnUs. Then the results were organized and insights were drawn, partially using the Importance Performance Analysis (IPA). User characteristics, constraints, and implications were then inspected, leading to the description of functional requirements. Design goals were set and reflections were made based on our research, and were actualized into sketches and mockups. In the middle of our project process, the official LearnUs application was launched. Thus we took that into consideration when designing the high fidelity prototype. With our prototype, we conducted a user research, comparing it with the official LearnUs application under various standards. Based on the reflections induced from the research, we revised the prototype design and noted some future resolutions to be made.

Current UI/UX critique

After the release of LearnUs, there have continuously been negative feedbacks about this newly introduced system, and thus we decided to analyze its user experience according to the following 10 UX principles:

- | | |
|---------------|-------------------|
| 1. Functional | 6. Visible |
| 2. Responsive | 7. Understandable |
| 3. Ergonomic | 8. Logical |
| 4. Convenient | 9. Consistent |
| 5. Foolproof | 10. Predictable |

According to our analysis, we have found 3 strengths and 7 weaknesses.

Strength

1. Functional
 - a. Provides the essential function for the students to take online courses without too much of a hassle nor difficulties
 - i. However, the server lags and freezes for some time whenever many users rush into the service is an issue
2. Consistent
 - a. Layout is unified with the main color theme of blue, a representative color of Yonsei University
 - b. UI is consistent and cohesive across different pages of the service
3. Predictable
 - a. User can easily figure out what is an interactive button and what is just plain text

Weakness

1. Responsive
 - a. Watching video lectures does not show a responsive progress bar or anything similar
2. Ergonomic
 - a. Disturbing pop-ups keep showing up
 - b. Video lectures open as separate pop-up windows

3. Convenient

- a. Speed control for video lectures is not supported on the first time of watch

4. Foolproof

- a. ‘Remember user name’ function is often inoperative
- b. ‘No longer show’ function for less-important pop-ups is often inoperable
- c. Closing video lecture pop-up asks ‘will you really leave?’ question even if the user have fully watched it

5. Visible

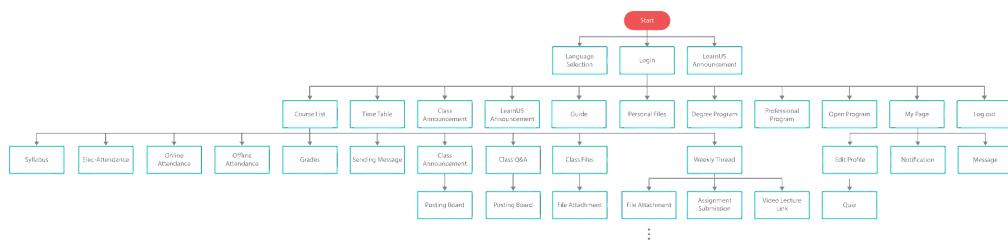
- a. Deadlines and upcoming events are not intuitively expressed on the calendar function
- b. Long screen design from top to bottom makes the user scroll for too long

6. Understandable

- a. Some icons are too abstruse
- b. Hands-on guidelines do not exist for the first-time users
- c. Too many ways to check the attendance
- d. Some functions are named unclearly
- e. Some elements are incomprehensibly grouped

7. Logical

- a. Even a brief analysis of the sitemap suggests that the service is designed more in a parallel way rather than a hierarchical order, with a flood of information in a single screen confusing the users.



<Partial Sitemap of LearnUs website>

Therefore, with this valuable information we gathered through UX critique, we intend to reinforce the strengths and supplement the weaknesses.

Literature Review

With the rise of technology, educational technology also rose, starting from higher education such as universities. Teaching-learning process has and is currently experiencing great change. (Wang, Wang, & Shee, 2007) Teaching is not restricted to face-to-face (F2F) instruction anymore, and is mostly a combination of F2F and online learning as it increases accessibility, flexibility, and interactivity. (Rosenberg & Foshay, 2002) This combination is implemented through the Learning Management System (LMS), also called “Course Management Systems” (CMS) or “Learning Content Management Systems” (LCMS).

To define LMS, it is an educational platform that can be used to provide online education and hybrid online and F2F learning. “According to the World Bank (2010), LMS is a software package that automatically administers education and trains human resources.” (Al-Busaidi & Al-Shihi, 2011) “An LMS provides an array of tools and functions to support teaching and learning, usually including course management tools, online group chat and discussion, homework collections and grading, and course evaluation.” It can provide instructional activities like giving information, managing course materials, and collecting and evaluating student work through an online platform that can be accessed anytime and anywhere. (Yueh & Hsu, 2008) “LMS helps manage the interactions between the learner and the eLearning and other related resources [while also helping] learners plan and monitor their progress in their learning journey.” (Irlbeck, 2007) It saves a lot of time for both educators and students as it organizes all of the information in one platform and also provides functions that lets education be able to be done online non-F2F.

Today, most academic institutions use LMSs to support their courses. For example, more than 90% of the academic institutions in the US adopted LMS (Hawkins and Rudy, 2007). While some universities use commercially available LMS systems, others developed their own LMS, most likely for reasons such as for better integration or to cut costs. Some examples of commercially available LMS products are Blackboard (www.blackboard.com), Schoology (www.schoology.com), Brightspace (www.d2l.com, formerly desire to learn), and Canvas (www.instructure.com/en-au/canvas). (Rosenberg & Foshay, 2002) Both commercially available LMS and University owned LMS have been evolving but still have space for improvement.

According to research done by Ashrafi, Zareravasan, Rabiee Savoji, and Amani the reason for the continuance of the use of LMS is mainly perceived usefulness, then perceived enjoyment, and subjective norm. Thus useful functions are a significant factor in the design and creation of a LMS. (Ashrafi, Zareravasan, Rabiee Savoji, & Amani, 2020) This shows that the major functions that are needed in the LMS have to function in an intuitive manner for the user to feel that it is useful and thus feel satisfaction. In the research done on Blackboard by Zanjani, Edwards, Nykvist, & Geva, 60 percent of the students stated the complex structure of Blackboard was one of the major problems of the LMS system. “Functions are hidden and are difficult to find in the different layers of Blackboard. There are many subfolders, and when users open a subfolder, they lose their overall view of

other folders.” (Zanjani, Edwards, Nykvist, & Geva, 2016) The functions should be clear and direct so that the students do not have to be confused and fumble around when they are already stressed by academics. As one student states, “It should be something that yells out at you how you can do it”. (Zanjani, Edwards, Nykvist, & Geva, 2016)

With the increase in the use of smartphones worldwide, and the smartphone ownership being 94% in South Korea where this research is being conducted, (Chu, Tak, & Lee, 2020) research was also done on mobile LMS (m-LMS). In a research done by Joo, Kim, & Kim on students in Korean Universities, the perceived ease of use of m-LMS predicted perceived usefulness, and perceived usefulness predicted satisfaction about m-LMS. This perceived usefulness and satisfaction led to continuous intention to use m-LMS. (Joo, Kim, & Kim, 2016) This shows how when the m-LMS is useful, students are likely to use the system while feeling more comfort and ease in their lives. In order for the m-LMS to be useful, the key design factor would be the ease of use. This will be kept in mind throughout the process of the research.

Requirements Gathering Methods and Results

To conduct the research, two research methods were used to analyze user behaviors. One was a general user survey on the satisfaction of LearnUs, and the other was an in-depth interview based on the survey results.

1. General Satisfaction Survey

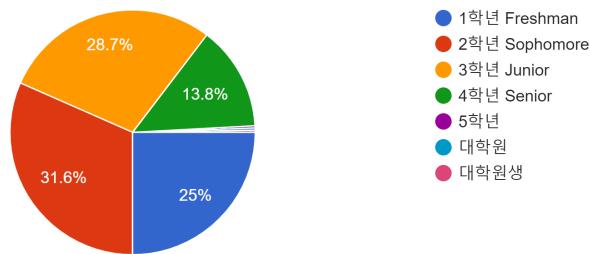
A. Method

A survey was conducted to gain general information about user experience of LearnUs. The survey was conducted on Yonsei University students who have experienced the LearnUs platform. Information such as usage frequency, satisfaction level on each device, importance and satisfaction level of functions were measured. Especially, importance and satisfaction level were measured to enable future IPA analysis. The survey focused on acquiring as much information as possible within a short survey form, keeping the short attention span of the users in mind. To promote more user participation, four food gifticons were given through random selection. Since the target respondents of the survey were Yonsei students who have experienced LearnUs platforms, the survey was distributed on various school group-chats, as well as Yonsei students’ timetable managing program’s community, Everytime. There was a total of 345 respondents, and the analysis of the responses was done through Google form’s charts and Microsoft Excel.

B. Results

현재 몇학년이신가요? Which year are you currently in?

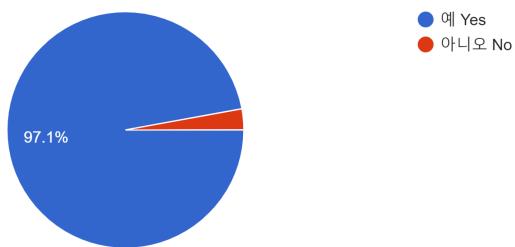
응답 348개



<Chart 1: Grade of Respondents>

런어스(LearnUS) 사용 경험이 있으신가요? Have you used LearnUs before?

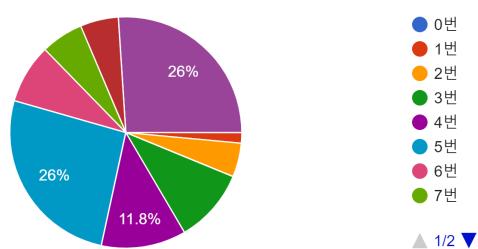
응답 348개



<Chart 2: LearnUs Experience>

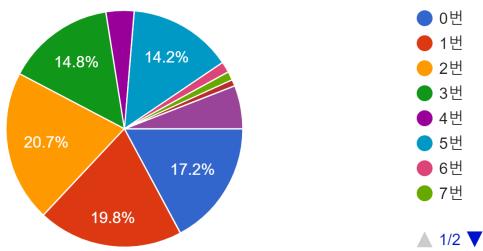
평균적으로 하루에 몇번 컴퓨터(노트북, 데스크탑)로 런어스에 접속하시나요? On average, how many times a day do you use your computer (laptop, desktop) to access LearnUS?

응답 338개



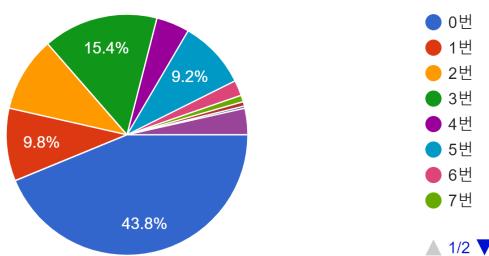
<Chart 3: Computer LearnUs Usage>

평균적으로 하루에 몇번 핸드폰으로 런어스에 들어가시나요? On average, how many times a day do you use your phone to access LearnUS?
응답 338개



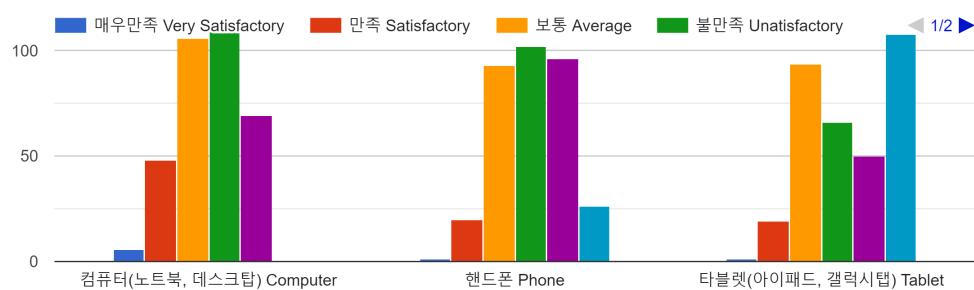
<Chart 4: Phone LearnUs Usage>

평균적으로 하루에 몇번 태블릿(아이패드, 갤럭시탭 등)으로 런어스에 들어가시나요? On average, how many times a day do you use your tablet(iPad, Galaxy Tab) to access LearnUS?
응답 338개



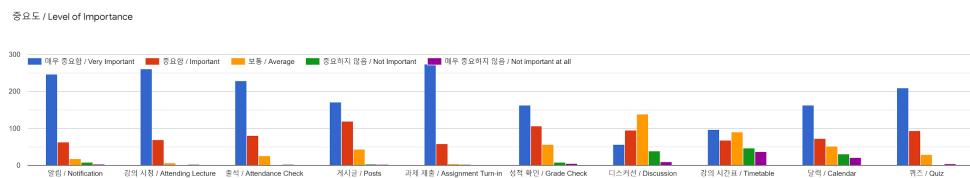
<Chart 5: Tablet LearnUs Usage>

아래 기기로 런어스를 사용했을때의 만족도를 매겨주세요 Please rate the satisfaction of using LearnUS with the device below.



<Graph 1: LearnUs Satisfaction Level on Different Devices>

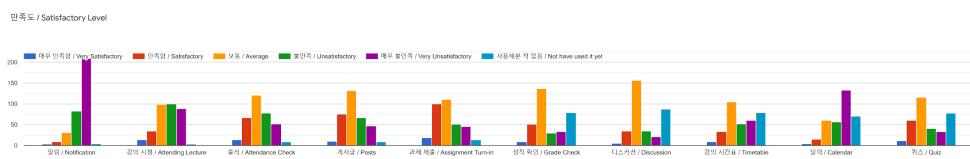
The usage rate of computers was relatively higher than the other two devices. 72% logged into the computer more than 5 times a day, but for tablet and phone, only 28% and 29% people have logged in more than 5 times. Computers were used the most, then phones, then tablets followed. However, there were many users who did not have tablets so counting only the actual users (discounting users who have answered 0 for the mobile device usage), the results changed. Computers were still the most used mobile device, then tablet followed, then phone. This means that less people own tablets but for the people who do, they use it more than phones when using it for LearnUs. The order of the satisfaction level for each device was the same, it was computer, tablet, then phone.



<Graph 2: LearnUs Function Importance Level>

Function Importance Ranking was as follows:

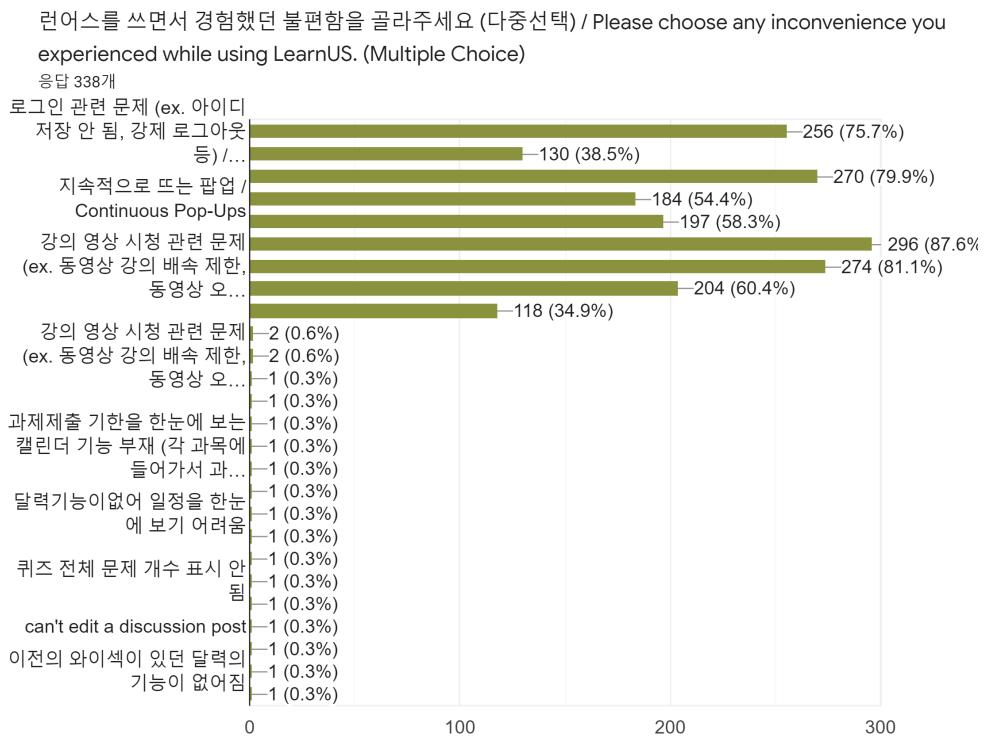
Assignment Submission > Watching Lectures > Notifications > Attendance > Quiz > Posts > Grade Check > Calendar > Discussion > Timetable



<Graph 3: LearnUs Function Satisfaction Level>

Function Satisfaction Ranking was as follows:

Assignment Submission > Quiz > Grade Check > Discussion > Posts > Attendance > Timetable > Watching Lectures > Calendar > Notifications



<Graph 4: LearnUs Inconvenience Experiences>

추가적으로 런어스를 개선하기 위한 요구사항이 있다면 적어주세요. (선택) / Please write down any additional requirements to improve LearnUS. (Optional)

응답 119개

과제 제출 전에 알림이 떴으면 좋겠다

과제/퀴즈가 모두 한눈에 알아볼수 있게 나와있던 캘린더가 없어져서 불편해요

enable minimizing and maximizing course week tabs.

로그인 유지, 쓸모있는 알림만 표시, 빠른 출석 확인, 개인 캘린더 기능 (과제 마감일 표시)

동영상콘텐츠 진도를 확인 어려움

강 강의들이 현실감 없음

그냥... 와이섹 씁시다.. 아님 성대처럼 러닝엑스 쓰거나

예정된 할 일 중 완료한 일을 자의적으로,자동적으로 삭제할 수 있었으면/ 나의 강좌의 상하 순서 뿐만 아니라 2열로 시간표 순서대로 배치할 수 있었으면

<Picture 1: Future Plan Suggestion Page>

When we asked participants to choose any inconvenience they experienced while using LearnUs through a checkbox questionnaire, many people chose an average of approximately 5.6 options.

The number of participants as well as the number of checkbox questionnaires responded shows the seriousness of the topic. The number of respondents for optional descriptive questions were high unlike other surveys, with more than $\frac{1}{3}$ of the total respondents.

C. Findings

i. Users use tablets more frequently than phones, but the number of users is much smaller.

According to survey question 4 and 5, the number of users using LearnUs through smartphones are 280, but those who use LearnUs through tablets are 190. However, even though the number of LearnUs smartphone users was larger, the order of usage frequency was different. LearnUs smartphone frequency was 3.32 per day while LearnUs tablet frequency was 3.59 per day.

ii. Users find computer-looking interfaces more satisfying.

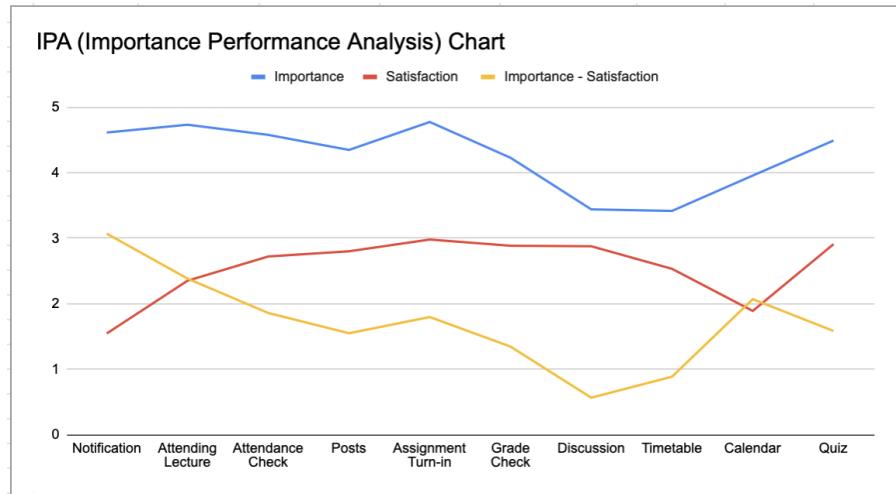
The usage frequency level was ranked as computer(6.16 times per day or more), tablet(3.59 times per day or more), and smartphone(3.32 times per day or more). Surprisingly, the satisfaction level has kept the same order. Computer first(2.44/5), tablet second(2.37/5), then lastly, smartphone(2.12/5). Because the original LearnUs was designed for web usage, it can be inferred that the closer the device is to the originally supported form, the higher the satisfaction will be.

iii. Users use computer LearnUs more than on any other devices.

According to survey question 3, all the respondents answered that they use computer LearnUs more than once a day. This can mean that smartphones and tablets cannot completely replace computers in LearnUs usage. LearnUs was designed for computers, therefore smartphones and tablets serve as a supplementary role in the process of studying.

iv. Users tend to be more dissatisfied with more important tasks.

The chart below shows IPA(Importance Performance Analysis) Chart in which we digitized the scale for importance and satisfaction, calculated the difference between importance and performance, and prioritized according to its result. As can be seen, the functions of higher importance tended to have lower satisfaction levels. This might be because important functions are used more frequently, and therefore people are more likely to feel unsatisfied with it whereas some of the unimportant functions tend to be rarely used. So the users might not know whether the function is working well or not. Especially, the remarkable drop of satisfaction level in *Notification* and *Calendar* shows that those two functions are in need of urgent revision.



<Importance – Satisfaction Level Ranking>

Notification > Watching Lectures > Calendar > Attendance > Assignment Submission > Quiz > Posts > Grade Check > Timetable > Discussion

2. In Depth Interview

A. Method

Interviews were conducted to hear more in-depth opinions based on the survey results. Eight students with different usage patterns were chosen to share their experiences. Before proceeding, interviewees were asked to complete the survey questionnaire above so that the survey results can thoroughly be discussed. The interview starts with asking the reasons behind the survey results. Then daily studying patterns and assignment tracking patterns were asked to be described. After that, interviewees were asked to perform the main functions of LearnUs while describing their thoughts and process by thinking out loud. The interview ended by asking ideas for future improvement. Around twenty minutes to 1 hour were taken for each interview based on how long the answers for each interviewees were. The interviews were recorded under participants' agreement for future transcription and accurate analysis.

B. Results

i. Users assign specific use for each device

Throughout the interview, it was found that each device had its specific usage. Computers were mostly used for assignment submission and watching lectures. However, phones and tablets were used for supplementary uses, such as checking notifications and notetaking.

"I use my phone to check notifications, announcements, or assignment grades... because it is easier" – Interviewee 5

“I log in with the computer mostly for assignment submission. When I do with my phone, I usually log in to check whether professor has uploaded anything”
– Interviewee 6

ii. Users are confused by the purposes of functions

The users have responded that they did not know that many of the functions even existed, or were confused by the functions. For example, few of the interviewees did not know *upcoming events* even existed in LearnUs. Since users do not know that the function exists, they mostly go into the course by clicking into the course page, not using *upcoming events* function, or *notifications* function. They also did not prefer having the *current week board* on top of the weekly threads. The reason was that it was hard to tell which week is which, and thus it led to confusion.

“LearnUs puts the current week on top. I think that’s even more confusing.” – Interviewee 7

“I don’t like the order of the weeks. It shows the current week, which moves week 1 to below, then 2nd, 3rd, so sometimes I get confused on where I am at.” – Interviewee 4

C. Findings

i. Users want an improved interface.

Interviewees responded that they like the new icons in LearnUs which did not exist in YSCEC since it enhances graphical intuitiveness. Other than the graphics however, they replied that the overall service design was not intuitive enough and was confusing. Therefore it can be concluded that the users want to see with less effort, and more guiding design.

“It’s not intuitive, and even the logos at the bottom are the same... It looks like an unfinished website...” - Interviewee 8

Adding on, it can be inferred that users want familiar designs with higher predictability. For example, one of the interviewees has mentioned that she wants the notification function to be like those of Facebook, that it should display all the notifications at once, with descriptions, and it should turn light grey into dark grey when checked (Interviewee 7). As many other respondents also showed dissatisfaction towards the notification system, it can be seen that the users want an improvement of the current system, more like those of familiar design.

ii. Users do not fully trust assignment-tracking functions.

Users have responded that they were dissatisfied with the removal of the visual calendar function. (Survey question 8). When they were asked how they manage their

assignments, all the interviewees responded that they do not use any LearnUs task management functions, but manually keep track of the assignments. They did not feel that the current function helps them keep track of their assignments and thus did not feel the necessity to use the function when they can manually write down the assignments, since using a calendar function is more confusing, and inconvenient.

“For example, I need to watch a video in two weeks. Then it doesn’t match the upcoming event, with what I really have to do. So it’s confusing.” – Interviewee 7

“The downside was that when the professors do not upload a post in a certain format, it doesn’t show up in the calendar. So I developed a habit of writing it on my own.” – Interviewee 8

iii. Users are confused by flood of information

In the current LearnUs, the notification list as well as the announcement list are flooded with information. Both functions are supposed to inform only important news, yet they burden the users with unimportant issues, making the users easily get tired of the alarms and tend to ignore the whole function.

“Upcoming events function is used more for watching lectures rather than schedule management. I can’t grasp it in one glance because everything is grey. I want to see the due date only, not all the information. I don’t use the function because it shows all the upcomings instead of those that I need.” - Interviewee 8

User Characteristics

Description of LearnUs users

Yonsei University students who are currently enrolled in the 2021 spring semester.

	Essay-Based	Quiz/Test-Based	Project-Based
Age / Occupation	Age 18~28, Yonsei Student		
Checking Frequency	Medium	High	Low
Main Usage	To complete attendance check essay, and to access class lecture	To complete attendance check quiz, and to access class lecture	To access class zoom link

Notification Usage	High	High	Low
LearnUs dependency	Medium	High	Low
Other Features	Check LearnUs often to check the due-date of assignments.	Checks LearnUs often to check if professor has uploaded any assignments.	Uses Google drive for projects so doesn't use LearnUs much.

<User Characteristics Table>

Persona

Persona 1

Our first user persona's name is Luna Lee. Luna is a senior student in the College of Engineering majoring in Mechanical Engineering. She is not only a student but is also a TA (Teaching Assistant). She is a heavy user of LearnUs as is a hardworking student who is passionate about her studies and also has to constantly help the professor upload posts and announcements. Luna has a GPA (Grade Point Average) of 4.2, and uses LearnUs with all of her electronic devices, laptop, tablet, and phone.

Luna is greatly unsatisfied about how she cannot get clear and proper notifications. Even when she is a very organized and alert person, she still gets confused because of the notifications. Now she has to go into each course and posts to check all of the updates, which she thinks is very not time efficient. Luna is also unsatisfied about how the visual calendar that used to be on YSCEC disappeared. She thought the function was really useful in visually showing what she had to do and thus reminding her of her schedule, and now that it is not there anymore, she feels a little insecure. Another insecurity that she feels is on attendance. She is afraid that the system may not have recorded her attendance after watching the online lectures and thus constantly goes back to check if her attendance got recorded. Even the process of going to check her attendance is confusing, and she thinks it's a waste of her time having to go check again when she would not have to if it was more clear. She has more additional complaints but she will keep it short and stop for time's sake.

The applications that Luna uses the most are Notability, Everytime, Forest, Google Drive, Spreadsheet, and Google Docs. All applications that can enhance her academics. Her average use of electronic devices each day are 6 hours for phone, 8 hours for computer, and 3 hours for tablet. Her life motto is: "Sleep is for after you die"

User Scenario

Wakes up at 9:00 as she always does. She prepares, washes up, downloads the material for the day on her tablet and goes into her class at 10:00 sharp. She listens to the lecture while writing notes on her tablet. The TA gives her a code for attendance and realizes that she

cannot do it on LearnUs itself and goes to find the Y-attendance application that she has not used for ages. She logs in and clicks to put in the code, and checks her attendance. While it says she has attended on the application, her attendance does not show on LearnUs, which makes her greatly insecure. After class, she immediately does her assignments, and tries to turn it in early, but there is an error in file size, so she has to adjust it and try to turn it in again. She is glad that she did her assignment early. Before she goes to sleep, she checks the notifications in LearnUs with her phone again, and is once again annoyed by how confusing the function is.

Persona 2

Our second user persona's name is Jihoon Kim. Jihoon is a sophomore student in the Underwood International College, Underwood Division, majoring in Economics. He is a light user of LearnUs as he does not care much about his studies and he only aims to do the minimum so that he can successfully graduate. Jihoon has a GPA of 3.3, and uses LearnUs with mostly his laptop, and very occasionally with his phone.

Jihoon is unsatisfied with how he cannot control the speed for his video lectures the first time he is watching them. He wants to get over with the lectures as fast as possible, and go out to hang out with his friends but LearnUs does not let him do so. He is also unsatisfied with how this attendance does not get recorded unless he "x" out of the lectures that he has finished watching. He just played the lectures and fell asleep one week, and realized much later that his attendance did not get recorded, which made him greatly annoyed.

The applications that Jihoon uses the most are Instagram, KakaoTalk, Youtube, Netflix, and Naver Webtoon. These applications are mostly for his entertainment purposes. His average use of electronic devices each day are 12 hours for phone, 4 hours for computer. His life motto is "YOLO"

User Scenario

Wakes up at 10:58 and goes into his lecture at 11:01. The next class is a recorded video lecture, and the professor uploaded the video already so he plays it in the background muted so that he can play it times 2 speed and quickly get over with it later. After he does this he falls asleep. He then wakes up as the class ends and goes back to screen record the lecture that he played in background at times 2 speed, so that he can watch it when he needs it before the midterms. While he does this, he chats with his friends about where they are going to meet later in the afternoon. After he has the time of his life outside, he comes in a little after 10 because of the COVID19 government limit, and tries to finish his assignment that is due at midnight. He quickly finishes his assignment and tries to turn it in at the last minute, but fails to do so, as the numerous buttons confuse him, and turns it in via email to the TA.

Constraints for User Research

The period of research was only around 2 weeks so there was a constraint in the ability to reach out to all of the users of LearnUs and get their views. If there was more time, additional interviews and surveys could have been conducted for more in-depth research and data. YSCEC is not available anymore, so it is hard to compare and contrast the differences. A voluntary response bias might have occurred as we did not poll from a completely random poll of students.

In addition, we promoted the survey with words such as “Those who are angry with LearnUs attention!” in order to get the attention of people and for them to participate, but afterwards, we reflected that the phrasing may make it so that the people who are satisfied with LearnUs do not participate, resulting in the survey results having a more negative opinion on LearnUs.

Another constraint was that LearnUs is a very recent platform that was created only a month ago, so there are lots of bugs and errors and is still being updated. Because it is a new platform, the survey and interview participants did not get the chance to use a lot of the functions yet. Some examples may be quiz and grade checking, as it is not the exam period yet. In addition, the researchers ourselves, although tried our best to find all of the functions that we could, may not have found all of the functions as we also had a limit in the time and accessibility to all of them. If there was a way to access and get to know all of the functions of LearnUs it may have been helpful for a more thorough research.

Implications

LearnUs users are dissatisfied with the current system because of the discomforts such as low intuitiveness, low predictability, and many other functional problems. For instance, the weekly threads are not easily distinguishable, nor does the notification list intuitively show the contents. The users find development of the application as one of the solutions.

“Mobile application would be convenient” - Interviewee 4

“When you have an application, it’s more approachable” - Interviewee 5

“I want LearnUs to have its own mobile application so that I can get announcement notifications” - Response of Survey Question 9

Even though mobile and tablets are often used as complementary devices, (83% mobile, 56% tablet - Survey Question 4,5) the satisfaction level of these devices is low. LearnUs is PC-based and optimized for the Web, making it difficult to be used in other devices.

Synthetically, mobile/tablet-based LearnUs applications should be created according to the way the devices are used. In addition, the application interface should be refined and more simplified to make it easier for the users to effectively utilize the system.

Functional Requirement Summary

Fundamentally, a learning management system should help facilitate educational content and manage courses. Specifically, a learning management system should have the following features.

- Provide dashboard functionality – allowing customized information to be presented to a user based on aspects such as courses, learning activities, and progress.
- Allow integration of multimedia in course contents
- Compatibility with mobile devices
- Integration with online conferencing platforms
- Test the knowledge of users
- Provide a gradebook with information on course results, grades and progress of participants. (Tadlaoui, M. A., & Khaldi, M., 2020)

According to the survey and interview results, we decided that the following are the functional requirements of LearnUs that the designers and developers must implement to enable users to effectively accomplish their tasks.

- Turn in Assignments
- Watch Lectures
- Check Notifications
- Take Quizzes
- Check Announcements
- Check Grades
- Check Online/Offline Attendance
- Check Elec-Attendance
- Check Syllabus
- Enter Real-time Classes
- Download class files
- Check Upcoming Event
- Check Calendar
- Check Timetable
- Participate in Discussions

The essential use cases of these functional requirements in the current LearnUs are specified in section below.

Critical use cases for our prototype section includes the critical use cases for all of the functionality we expected to implement in our prototype. It would have the same functional requirements as the web version of LearnUs but modifications in the critical use cases were made so that the workflow is improved and more organized.

Then the context of use was addressed, in other words, the physical environment and situational context in which our mobile application will be.

Then, we rebuilt the workflow of the mobile version of LearnUs so that the functional requirements would not only be met, but the procedures would also be improved in visibility, convenience, understandability, and functionality.

Functional Requirement Details

Critical Use Cases (Current LearnUs)

Turn in Assignments

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
Select assignment	Display submission status
Add submission	Offer dropbox for file submission Offer save/cancel button
Add files	
Save	Confirm submission

Watch Lectures

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
Select lecture video	Display video window
Watch	Play video
Exit	Save progress

Check Notifications

User Intention	System Responsibility
Identify self	Display home page
Check my page	Display menu
Go to notifications	Display new notifications Offer “View all messages” button Offer “View all notifications” button
View all notifications	Display all notification messages
Check notifications	

Take Quizzes

User Intention	System Responsibility
Identify self	Display home page
Check notifications	Display course page
Take quiz	Display quiz window Display “Take quiz now” button
Take quiz now	Display quiz questions
Solve quiz questions End quiz	Display “Submit” button
Submit	Save answers

Check Announcements

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
Select announcements	Display all class announcements
Choose post	Display content of post

User Intention	System Responsibility
Identify self	Display home page
Select a post in current class announcements	Display content of post

Check Grades

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
View course details	Display hamburger menu
Select grades	Display user report
Check grades	

Check Online/Offline Attendance

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
View course details	Display hamburger menu
Select online/offline attendance	

	Display attendance status
Check online/offline attendance	

Check Elec-Attendance

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
View course details	Display hamburger menu
Select elec- attendance	Request identification
Identify self	Connect to Elec-Attendance System
Check elec- attendance	

Check Syllabus

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
View course details	Display hamburger menu
Select syllabus	Display syllabus

Check syllabus

Enter Real-time Classes

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
Select scheduled real-time session	Connect to Zoom

Download class files

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
View class files	Display class files with icons that indicate the file format
Download class files	Download file to computer

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page

Select file to download
from weekly thread

Download file to computer

Check Upcoming Event

User Intention	System Responsibility
Identify self	Display upcoming events on the right of the home page
View upcoming events	

Check Calendar

User Intention	System Responsibility
Identify self	Display home page
View more upcoming events	Display Calendar page Offer filter buttons for courses Offer “add new events” button Offer “export” button
Export Calendar	Offer choice of events to export Offer choice of time period Offer “Get calendar URL” button Offer “Export” button
Choose events to export Choose time period Choose Export	Download ics file to device

Check Timetable

User Intention	System Responsibility
Identify self	Display home page
Select timetable	Display timetable
Check timetable	

Participate in Discussions

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
Go to discussion module	Display discussion page
Write	Provide post window
Save	Upload the writing to the discussion page

Critical Use Cases (Revised LearnUs Mobile Prototype)

Turn in Assignments

User Intention	System Responsibility
Identify self	Display home page

Select a course	Display course list
Select weekly thread	Display weekly thread
Select assignment	Display submission status
Add submission	Offer dropbox for file submission
Add files	Offer save/cancel button
Save	Confirm submission

Watch Lectures

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course list
Select weekly thread	Display weekly thread
Select lecture video	Display video window
Watch	Play video
Exit	Save progress

Check Notifications

User Intention	System Responsibility
Identify self	Display home page
Go to “Notifications” tab	Display all notification messages
Check notifications	

Take Quizzes

User Intention	System Responsibility
Identify self	Display home page
Check notifications	Display course list
Select weekly thread	Display weekly thread
Take quiz	Display quiz window
	Display “Take quiz now” button
Take quiz now	Display quiz questions
Solve quiz questions	
End quiz	
Submit	Display “Submit” button
	Save answers

Check Announcements

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course list
Select announcements	Display all class announcements
Choose post	Display content of post

Check Grades

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course list
View grades	Display user report
Check grades	

Check Online/Offline Attendance

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course list

View attendance	Offer elec-attendance, online/offline attendance
Select online/offline attendance	Display attendance status
Check online/offline attendance	

Check Elec-Attendance

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course list
View attendance	Offer elec-attendance, online/offline attendance
Select elec- attendance	Request identification
Identify self	Connect to Elec-Attendance System
Check elec- attendance	

Check Syllabus

User Intention	System Responsibility
Identify self	Display home page
Select a course	

	Display course list
View syllabus	
	Display syllabus

Enter Real-time Classes

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course page
Select weekly thread	Display weekly thread
Select scheduled real-time session	Connect to Zoom

Download class files

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course list
Select “Class Files”	Display class files with icons that indicate the file format
Download class files	Download file to mobile device

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course list
Select weekly thread	Display weekly thread
Select file to download from weekly thread	Download file to mobile device

Check Upcoming Event

User Intention	System Responsibility
Identify self	Display home page
Go to “Upcoming Event” tab	Display upcoming events
View upcoming events	

Check Calendar

User Intention	System Responsibility
Identify self	Display home page
Go to “Calendar” tab	Display Calendar page
View Calendar	

Check Timetable

User Intention	System Responsibility
Identify self	Display home page
Select timetable	Display timetable
Check timetable	

Participate in Discussions

User Intention	System Responsibility
Identify self	Display home page
Select a course	Display course list
Select discussion	Display discussion page
Write	Provide post window
Save	Upload the writing to the discussion page

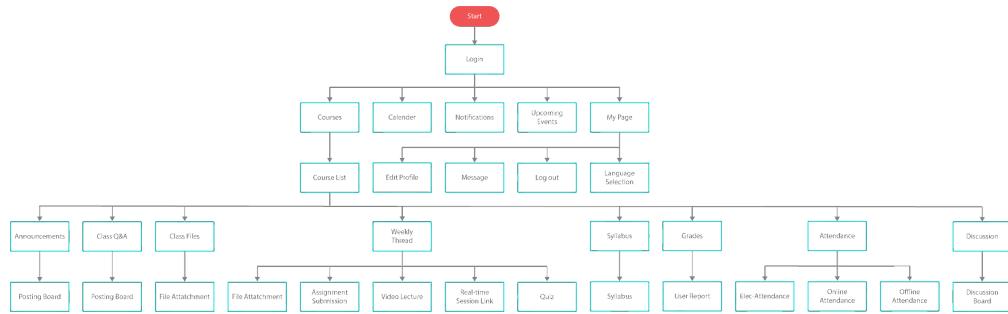
Context of Use

The intended users of LearnUs are Yonsei students. After conducting the interview, we learned that LearnUs is mostly used in studying environments. However, the physical environment in which the system is used might vary according to the device. For example, many students connect to the PC and tablet version of LearnUs at home, library, or cafes where internet connection is provided and where they can listen to lectures and do assignments for a relatively long period of time. On the other hand, students usually access LearnUs through their mobile phones wherever they wish to quickly check notifications or submissions.

Our application will be used in similar situational contexts as the mobile use of LearnUs. There are instances where students are unable to connect to Wi-Fi or use computers, such as when they are using the transportation or while they are on the go. In these circumstances, students will be able to conveniently check notifications or submission status through the application. Furthermore, there might be times when it is simply too troublesome to turn on laptops or desktops to check schedules, such as in the bed before sleep. Students can easily check if they forgot any assignments or upcoming events through our service.

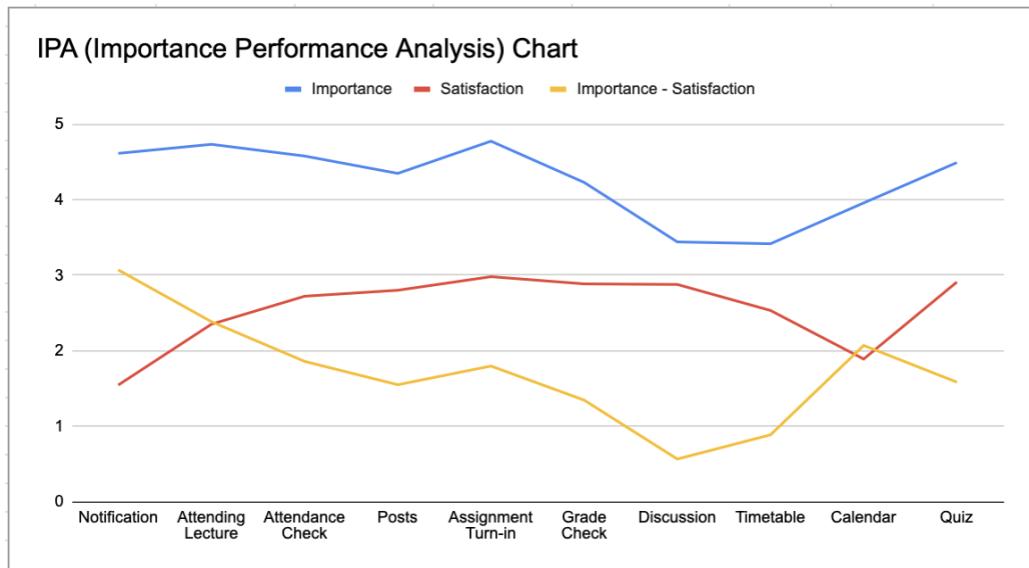
More importantly, the notifications will be displayed outside the application's UI to provide the users with reminders, and other important information from courses. Users can tap the notification to open the application and check any new information immediately, regardless of where they are.

Diagram of Workflow



Design Goals

Based on the results deduced from our survey analysis, we ranked the amendment priority of each function through IPA (Importance Performance Analysis) The result is as following:



The result is, by an ascending order, notification, attending lecture, calendar, attendance check, assignment turn-in, quiz, posts, grade check, timetable, and discussion.

With the result, we then broke the problem of each function down into 10 UX principles discussed in the previous ‘UI / UX critique’ section in this report, based on the user interviews we conducted. The frequency of the use of an aspect is proportional to the priority for revision and change. The results are as following:

Rank	Functions	Faulty UX principle
1	Notification	Visibility, Convenience, Predictability
2	Attending Lecture	Functionality, Foolproof, Responsiveness
3	Calendar	Visibility, Convenience
4	Attendance Check	Responsiveness, Convenience

5	Assignment Turn-in	Convenience
6	Quiz	Convenience, Understandability
7	Posts	Visibility

Grade check, timetable and discussion were exempted from the deeper analysis since there were many users who do not know of their existence and tend to find them unimportant or satisfactory with the existing function.

To elaborate on each of the faulty UX principles for each function,

1. Notification

- A. *Low visibility* due to lack of course name and lacking description about the notification itself & chunks of similar notifications stacked with no prioritization in importance.
- B. *Inconvenient* since all the notifications disappear even if you click only one of them.
- C. *Unpredictable* since certain options automatically download the file right away, while other options take me to the download page (even with the same icon)

2. Attending Lecture

- A. *Low functionality* since the absence of speed control on the first watch is one of the biggest discontents.
- B. *Faulty foolproof* since it asks the users if they actually want to close the window with the risk of ‘progress not being saved,’ confusing the users if they need to do anything else before closing for the attendance to get checked.
- C. *Lack of responsiveness* since users expect to see the progress rate of the lecture while watching the lecture.

3. Calendar

- A. *Low visibility* since users expect a cell-type monthly calendar with 7 columns, while what they get in LearnUs is an unintuitive list of upcoming events and due dates.
- B. *Inconvenient* since the name of the lecture is not displayed and users must click into each of the events to see what lecture it is for.

4. Attendance Check

- A. *Lack of responsiveness* since it is not directly displayed while watching the lecture, and zoom attendance is not automatically recorded.
- B. *Inconvenient* since there are 3 options for checking attendance: elec-attendance, online attendance, and offline attendance, confusing the users of which option they should choose to check their attendance.

5. Assignment Turn-in

- A. *Inconvenient* since there are redundant buttons and steps to turn an assignment in.

6. Quiz

- A. *Inconvenient* since there are too many buttons to click
- B. *Lack of understandability* since the options are too diversified and one of the interviewees even had to randomly click the buttons and somehow the quiz got submitted.

"I just don't know what the buttons do. I just want to submit it, but I don't know the difference between the buttons because it doesn't tell us what to do and what the buttons are for, so for me it just seems like I have to click endless buttons to get what I want." - Interviewee 4

7. Posts

- A. *Lack of visibility* since 'this week' board is fixed on the top, but without clear and eye-catching difference from other weeks, confusing the users.

Based on the analysis done so far, we have set the design goals to revise in the aspects of UX principles in the following order:

1. Convenience
2. Visibility
3. Understandability
4. Functionality & Responsiveness

Finally, the specific design goals were set accordingly to each critical use cases as following:

Task	Design Goal	Design Details
Turn in Assignments	Improve convenience	Deduct unnecessary processes

Watch Lectures	Function addition	Add speed control function for first-time watching
	Revise foolproof	Deduct unnecessary foolproof process when closing the window
	Enhance responsiveness	Display the progress status in real-time
Check Notification	Enhance visibility	Add course name and description of each notification
		Customizable priority in information
	Improve convenience	Make notifications be available even if one notification is checked, marking the checked option box light grey
	Improve predictability	Unify interactive function within the same buttons
Take Quizzes	Improve convenience	Deduct the number of buttons and simplify them
	Enhance understandability	Simplify the interaction and make the process more straightforward
Check Announcements	Enhance visibility	Organize the boards in a hierarchical manner and increase visibility with the

		use of color theme and highlights
Check Grades	Improve convenience	Make the function easily accessible and organize it
Check Online/Offline Attendance	Enhance responsiveness	Display the attendance and progress status while watching the video lecture
	Improve convenience	Integrate two functions into one
Download Class Files	Improve Convenience	Make the option available in two different process so that users can choose which one they prefer better
Check Upcoming Event	Enhance visibility	Display course name and make the date more visible through visual emphasis
Check Calendar	Enhance visibility	Change the calendar into a more intuitive monthly calendar format
	Improve convenience	Make the calendar customizable so that it could be used for task management purposes

Design goals focus on major functions induced from the survey analysis, thus some of the functions may be posterior in designing.

Design Space

Mobile application is the design space we chose for the project. Since the goal was to revise the cumbersome mobile LearnUs and enhance the user experience system by organizing certain functions and designing a mobile native interface, choosing a mobile application apart from any other form of services like VR, AR as our design space is an obvious choice.

Accessibility is one of the key requirements for the service, since students must be able to perform educational interaction at any time and place, and a mobile application would fulfill this condition the most. According to the user research conducted in P1, users found the current mobile interface of LearnUs unsatisfying, resulting in most of the usage concentrated on PC. Plus, user interviews suggested that mobile applications of LearnUs will come in handy and be more approachable to users in various situations and make the usage more flexible. A touch navigation method was chosen over other options like voice or drag was chosen for fast responsiveness and better intuitiveness. Educational application format was chosen over gamification since the operation of the tasks had to be simple, intuitive, and functional over being enjoyable to use.

The first candidate for the application design is a fully functional mobile application that inherits all the functions within the PC LearnUs system, but revising the interface and reorganizing the information architecture so that it would satisfy the users better. The main UX principles we tried to improve are convenience, visibility and understandability. By making an application with mobile native interface and clearing out the disturbances the users had with using the mobile interface of original LearnUs, we seek to improve convenience by providing access to the service at any time and place with their smartphones. Interfaces have been revised to increase visibility on notifications for the newly uploaded contents. Calendar and to-do list has also been redesigned to enhance usability, and notifications with too much cognitive load have been renewed to enhance understandability.

Some alternative options were considered but discarded, like the option that exactly follows the flow chart and information architecture of the PC LearnUs, or the option that shallows the interaction depth to the minimum. First option, which follows the architecture of the original PC LearnUs but with a mobile-native interface, was discarded due to the insufficient enhancement in user experience. Although its information architecture would have been familiar to the users since it would require no additional learning to the users who already use the PC LearnUs, it would not have resolved the problems brought up by the users in our previously conducted user research and fundamental resolutions had to be done with the information architecture as well. Second option of an application trial, task-oriented application shallowing the interaction depth by expanding the buttons to show further information was also turned down due to the lack of flexibility in the interface and too much requirement for the users to learn, making it less intuitive. Its low action counts and the cohesive, seamless interaction might have been one of the factors that could have enhanced the user experience, but the convenience and understandability was a bit shorter than the final alternative of the fully functional application.

Thus, the final version was chosen as our first candidate, which is the fully functional application with a revision in information architecture, flow chart and mobile-native interface. Also, the interface design is done in an intuitive way to lessen the burden for the users to learn about the application. According to the Danish usability consultant, Jakob Nielsen, “users spend most of their time on other sites, meaning that users prefer the site to work the same way as all the other sites they already know.” (*Yablonski, Jakob's law*) Therefore, we tried to implement the interfaces of social media apps that our user group frequently uses, like Facebook, Instagram, Twitter and Kakaotalk. New items and notification systems have been redesigned to better fulfill the Von Restorff effect, which suggests that one object that differs from multiple similar objects is most likely to be remembered and noticeable. (Parker, Wilding, & Akerman, *The von restorff effect in visual object recognition memory in humans and Monkeys: The role OF Frontal/perirhinal interaction* 1998)

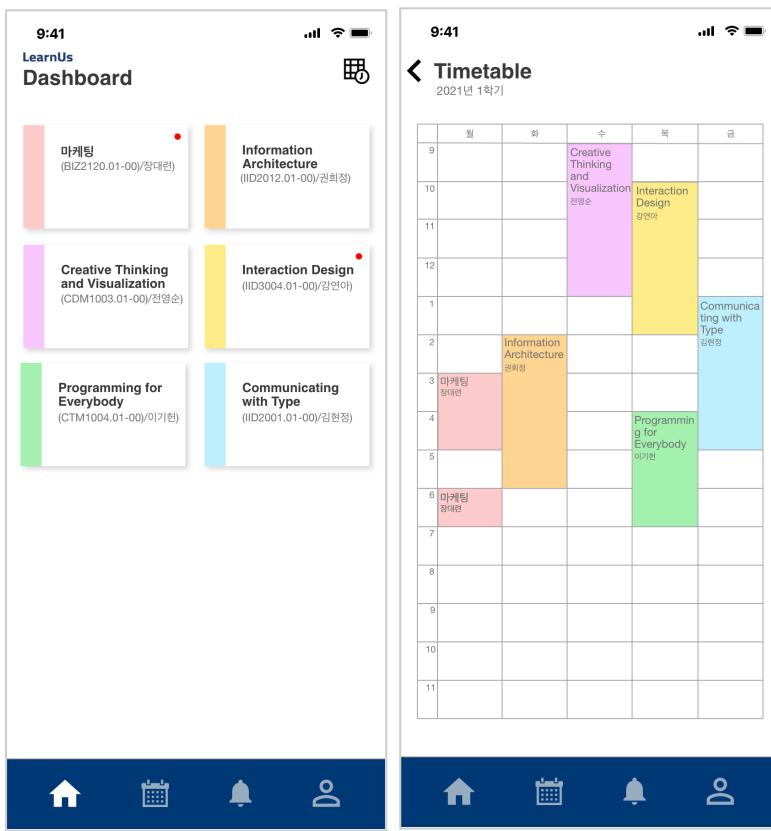
However, to avoid providing cognitive load in one page, we plan to integrate the calendar and to-do list function in one page, and this is quite worrying whether the users will be able to distinguish each feature or not. Furthermore, the dashboard page for the lecture page is the main page for the application, but intuitiveness was traded off for the shallow depth of interaction and is quite ambiguous how the users will react to it. Despite these worries, we do believe that the interface we newly designed will provide a better experience for the users than the original mobile adaptive web of LearnUs, in the sense that notification, to-do list and various functions in the course list page is easier for the users to identify and access, with enhanced convenience.

The second candidate for the application design is rather a lightweight, supplementary application that simply focuses on to-do list, calendar, and notification function. Since most of the interaction with the LearnUs system occurs mostly on PC, this version of the application simply reads the information from the LearnUs webpage and delivers it to the users, but with improved visibility, convenience, and understandability. Implementing the Pareto principle, which states that “roughly 80% of consequences come from 20% of the causes” (*Bunkley, Joseph Juran, 103, pioneer in quality Control, dies 2008*), we resolutely excluded functions other than what the users sought from the mobile application, according to the results we retrieved from previous user research. According to the user interview, functions like watching lectures, turning in assignments, or taking quizzes would take place in their computers rather than mobile devices for most of the users. Thus, we took out those unessential functions for the mobile application and focused on enhancing the features the users would want the most from a supplementary mobile application, while reducing the cognitive load. To follow Jakob's Law, the to-do list and calendar function mimics the interface of conventional calendar applications in most of the smartphones, and to-do list function to that of analog diaries. Notification mimics the interface of notification systems on familiar social media applications like Facebook, Instagram, Twitter. Through this application, it is expected that users will be able to save their pain of going back and forth between the digital information provided on the LearnUs webpage and any tools they use to keep track of their work.

Interface Designs

(1) Full Function – Course Centered

The first design solution was to create a **full function** mobile application for LearnUs but organize the workflow and improve the interface so that the existing problems would be solved. When we conducted the survey and interview, we found out that users are confused by the purposes of the functions, and that users want an improved interface. Our goal was to let students access the full function of LearnUs through the mobile application regardless of where they are, with convenience and an improved interface.



We replaced the homepage with a dashboard page consisting of a list of courses to minimize the amount of information provided in the homescreen. Each course was assigned a color for enhanced visibility and a red dot was put to indicate new notifications. A red dot is often used to indicate new notifications in social apps such as Facebook and Kakaotalk. We thought that the meaning would be easily communicated to users who are familiar with such apps. On the top right corner, we put a button that would lead to the timetable page for students to access conveniently.

We utilized a navigation bar because it allows rapid switching between core functionalities. Also, it easily communicates the current location of users. We used the same color code as LearnUs for the navigation bar to minimize confusion and to keep the Yonsei identity. There are four buttons in the tap bar: home, calendar, notification, and my page.

In the survey that we conducted, “Calendar” function and “Notifications” function were ranked as the most unsatisfactory. During the interview, we found out that mobile devices were mostly used for checking notifications, announcements, or assignments grades. In Particular, we found out that many students didn’t even know that the “Calendar” function even existed, because it was hidden. From these findings, we thought that it would be

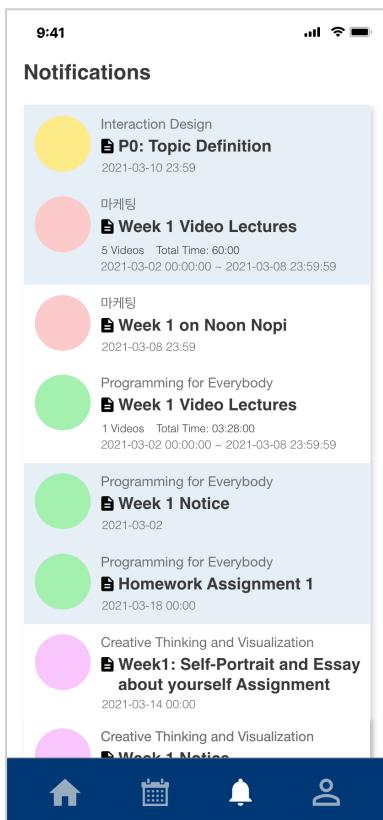
convenient for users to access the “Calendar” function and “Notifications” function easily from the tap bar, where the functions are always visible and available.



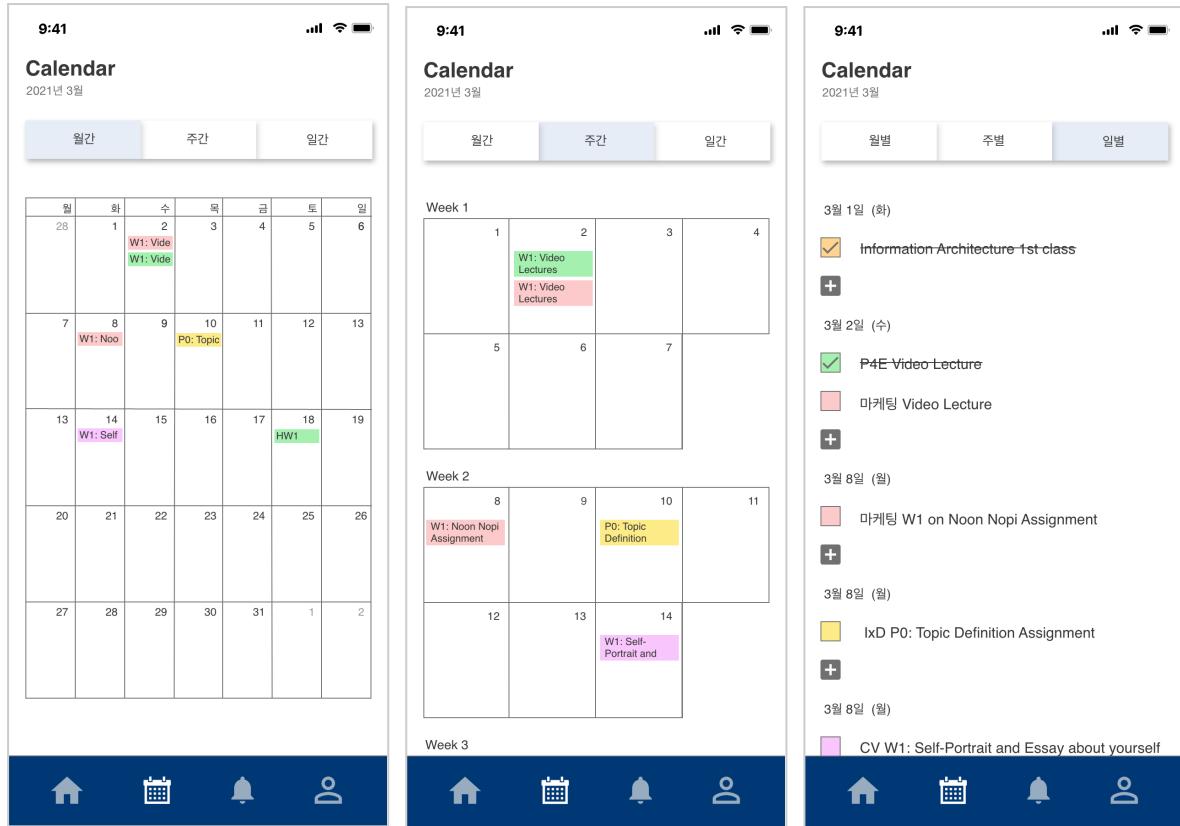
The course page was made to look similar to the PC version of LearnUs so that users can adapt easily to the mobile environment. However, the “Class announcement”, “Class Q&A” and “Class Files” buttons were moved to the top to prevent the top bar from taking up too much space. The top bar will remain fixed even when the users scroll through the weekly threads for users to access the functions at any time.

We took out the function that redundantly has the current week on the top, and appears again in the middle of the weeks as users complained about the confusion that arose from this function. Rather, we devised a design where the current week would be automatically fixed to the top, while you can swipe down to see previous weeks.

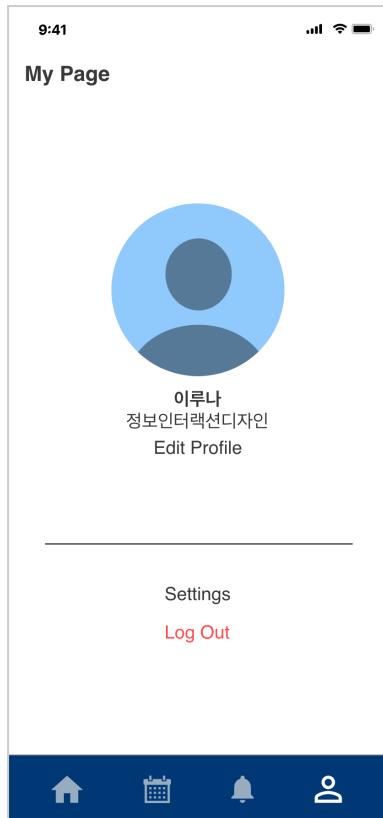
Like the current LearnUs system, it is possible to use all functions in the course page, such as turning in assignments, watching lectures, downloading class files, and checking attendance.



In the notifications tab, we implemented new functions to enhance visibility. First, we added the course name and description of each notification, taking into account many responses from users that required this function. Also, we fixed the faulty design of current LearnUs where all notifications disappear when one is clicked on. In our design, the checked notifications are marked white, mimicking the notification function of Facebook which users are used to. Color was also added to indicate the courses, coherent with the dashboard page, to enhance visibility.

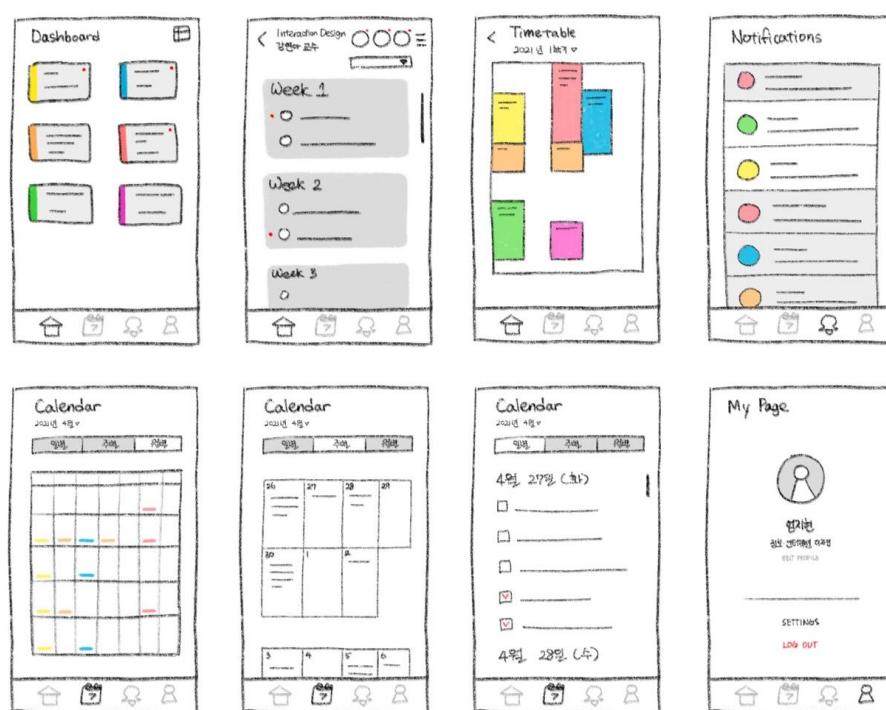


The calendar was changed into a more intuitive monthly calendar format. Weekly, and daily tabs were also added in the Calendar tab, which are functions that many calendar apps like Google Calendar or Kakao Calendar provide. This was intended to save the user's time and effort in adapting to the new interface. With the calendar function, students can check assignments and tests that are automatically scheduled by receiving information from LearnUs database, while they can also customize it by adding their personal schedules in their daily to-do lists. Color was also added to indicate the courses, coherent with the dashboard page, to enhance visibility.

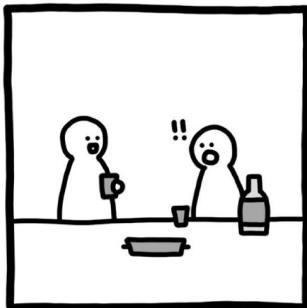


In My Page, users can edit profile, change their language settings, notification settings, and logout. A lot of respondents expressed the need for push notifications in both the survey and the interview. Therefore, we decided to add the push notification function to our application.

Many users pointed out problems related to login (ID not saved, unintended logout) as an inconvenience they experienced while using LearnUs. In order to minimize such inconvenience, our application has the “Keep me logged in” feature, so that users won’t have to log in every time like they do in the current LearnUs system. In My Page, users are able to log out, which will lead them to the login page.



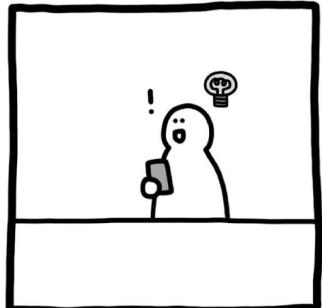
<Sketch for course-oriented fully functional application>



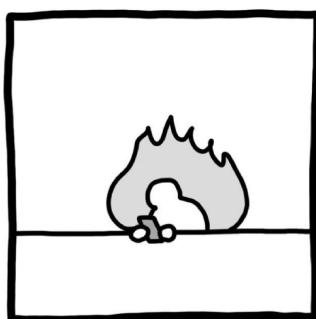
1. The user realizes that he forgot to turn in the assignment.



2. Unfortunately, it's too late to go back home to turn it in.



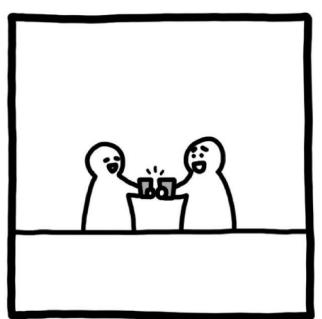
3. The user remembers that he can upload by using the mobile app.



4. The user quickly downloads his files from Cloud service.



5. The user uploads the file using the app.



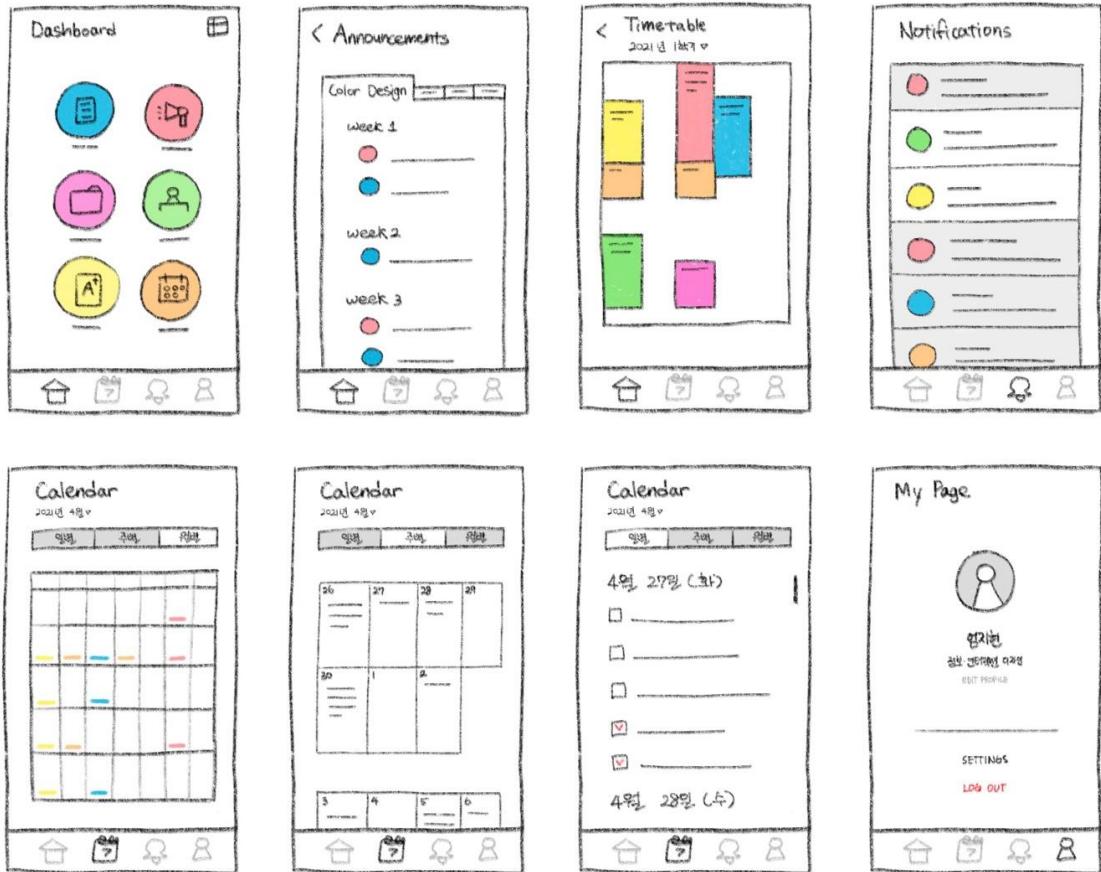
6. After turning in the assignment, users continue their quality time.

<Storyboard for course-oriented fully functional application>

Situation where a student is enjoying time outdoors and tries to turn in an assignment that he forgot to turn in.

(2) Full function – task centered

In another idea for a design solution, we thought about a task-oriented interface, which would show a dashboard page consisting of a list of tasks. However, we faced the problem that another course list page would be needed inside each task page, which would only create another hierarchy. Therefore, we discarded this idea and focused on the course-centered design for our full-function mobile application.



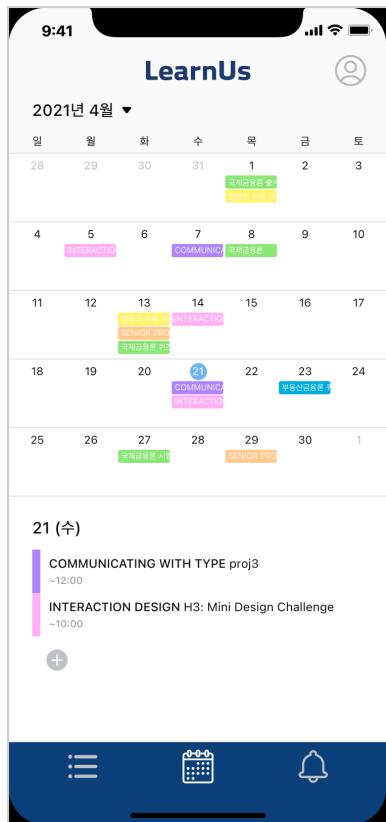
<Sketch for task-oriented fully functional application>

(3) Supplementary

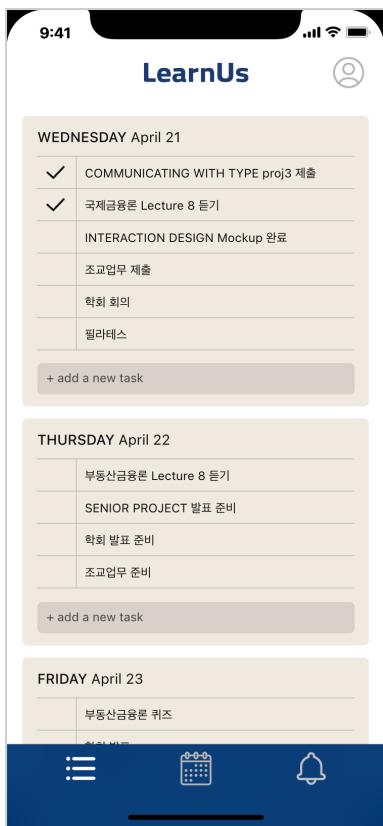
From the interviews with Yonsei students, we found out that users assign specific uses for each device. One important observation was that phones and tablets were used for supplementary uses, such as checking notifications and notetaking.

Also, many users responded that they were dissatisfied with the removal of the visual calendar function. When they were asked how they manage their assignments, all the interviewees responded that they do not use any LearnUs task management functions, but manually keep track of the assignments on their phone, or by hand.

From these insights, we devised the third design solution, which is interface design for **supplementary** services. We kept only the notification and assignment-tracking functions (to-do, calendar) and removed all other functions. Our goal was to keep the application light and focus on the role of the mobile application as a supplementary learning tool.



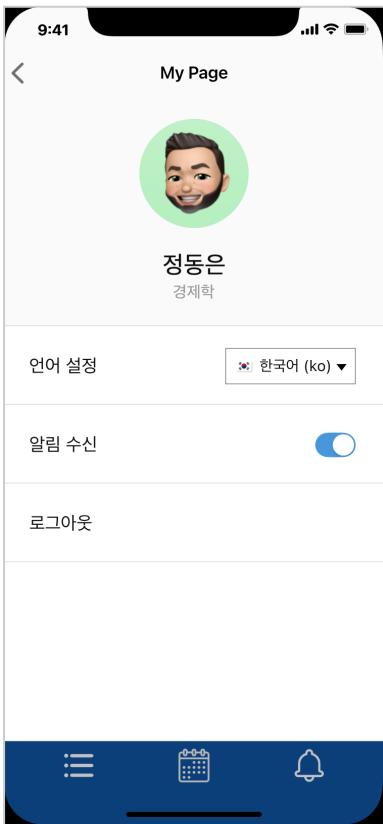
The calendar page was made to look similar to other calendar apps, so that it takes less time and effort to adapt to the interface (*Jakob's Law*). With the calendar function, students can check scheduled assignments and tests, while they can also customize it by adding their personal schedules. Color was also added to indicate the courses, coherent with the dashboard page, to enhance visibility.



The interface of the to-do list page was made to mimic that of analog diaries. Daily to-do lists were divided into sections, and users can mark tasks as done by checking the boxes on the left. Users are able to add new tasks by clicking on the “add a new task” button.

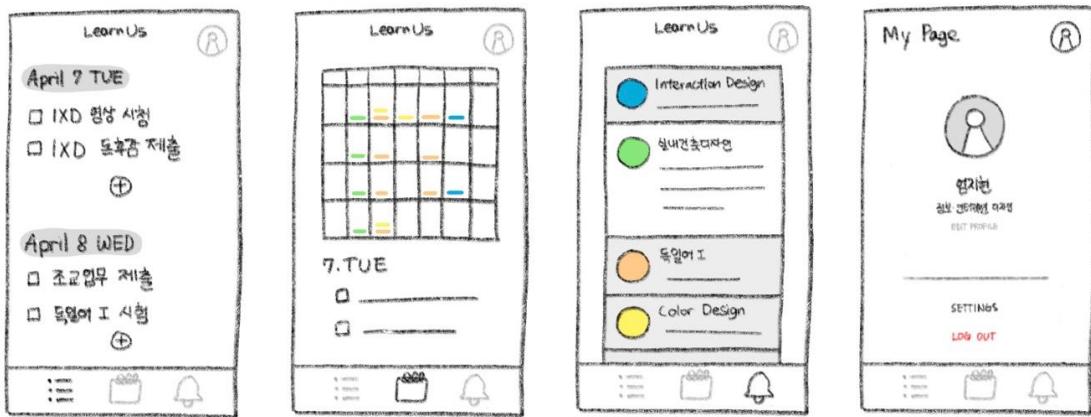


In the notifications tab, we implemented new functions to enhance visibility. First, we added the course name and description of each notification, taking into account many responses from users that required this function. Also, we fixed the faulty design of current LearnUs where all notifications disappear when one is clicked on. In this design, the checked notifications are marked grey. However, unlike the full-function mobile application, our goal in making the supplementary version was to minimize its functions and provide only the functions needed for check-up. Therefore, our idea was to let the notification boxes expand when clicked on, but it wouldn't lead the users to the actual link or post.



Users are able to access My Page by clicking on the grey icon on the top right of every page. In this design, we didn't put My Page in the navigation bar but moved it to the top right to keep it consistent with the original version of LearnUs. In My Page, users can change their language settings, notification settings. A lot of respondents expressed the need for push alarms for notifications in both the survey and the interview. Therefore, we decided to add the push alarm function to our application, and a toggle button was put to enable or disable push alarms for notifications.

Many users pointed out problems related to login (ID not saved, unintended logout) as an inconvenience they experienced while using LearnUs. In order to minimize such inconvenience, our application has the “Keep me logged in” feature, so that users won’t have to log in every time like they do in the current LearnUs system. In My Page, users are able to log out, which will lead them to the login page.



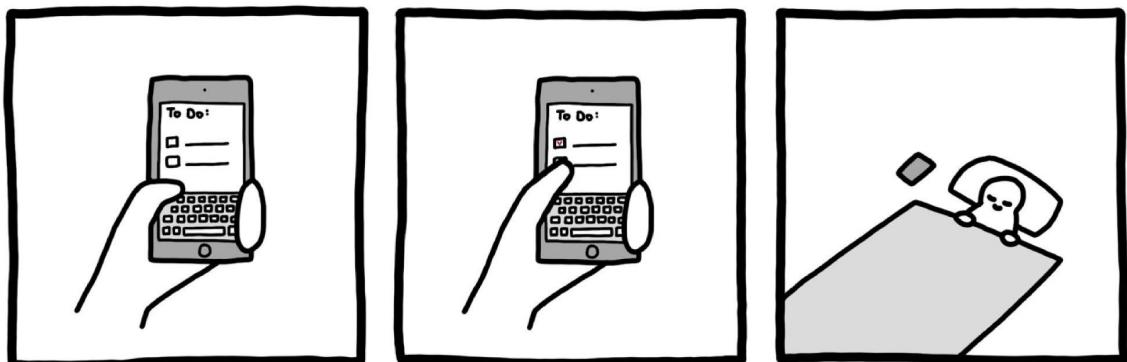
<Sketch for supplementary application>



1. The notification wakes the user up.

2. Oh no! The professor posted new assignment!

3. The user checks the calendar and plans when to do the assignment.



4. The user types in the new assignment in the to-do list.

5. The user checks out finished assignments.

6. After turning planning out things, the user falls back asleep.

<Storyboard for supplementary application>

Situation where a student receives notification in bed and adds a date to do a new assignment to the to-do list/calendar before going back to sleep.

Assessment of Designs

Action counts on critical use cases

Critical Use Case	Original LearnUs	Fully functional App	Supplementary App
Turn in Assignments	7	5	-
Watch Lectures	6	4	-
Check Notifications	4	2	2
Take Quizzes	7	5	-
Check Announcements	4	3	-
Check Grades	4	4	-
Check Online/Offline Attendance	5	4	-
Check Elec-attendance	6	5	-
Check Syllabus	3	2	-
Enter Real-time classes	4	3	-
Download Class Files	4	3	-

Check Upcoming Events	3	2	2
Check Calendar	4	2	2
Add task on to-do list	-	6	4
Check completion of the task	-	4	2
Participate in Discussions	5	4	-

Pros / Cons

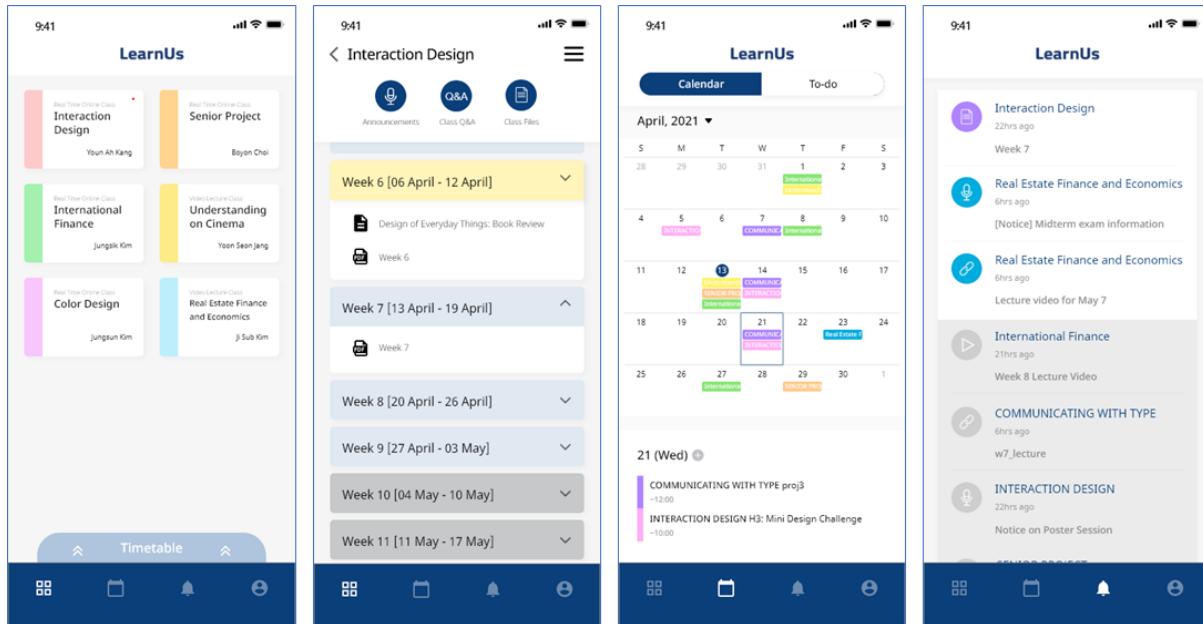
Based on the design trials achieved, we would like to assess the pros and cons of each alternative in a table format. It is not a formal evaluation or have gone through user testing yet, but rather subjective opinions on each UX principles and elements. We added another criteria of simplicity because it was the key function of supplementary application design. They will be marked very good, good, similar, bad, very bad according to their relativity to the original LearnUs, and the elements that consequent the rank.

UX principles	Fully functional application	Elements	Supplementary application	Elements
Functionality	Very good	Calendar / To-do list / Push-alarm notification	Very Good	Calendar / To-do list / Push-alarm notification
			Very Bad	No course list page function

Responsiveness	Similar	-	Bad	Pressing notification doesn't take the user to the contents page
Ergonomics	Good	Navigation bar to help users navigate between functions more easily	Good	Navigation bar to help users navigate between functions more easily / buttons populated on the bottom of the screen
	Similar	Buttons expected to be frequently used in the course page is on top of the screen		
Convenience	Very Good	Color classification on courses / To-do list and calendar linked to the LearnUs system	Very Good	Color classification on courses / To-do list and calendar linked to the LearnUs system
	Good	Interaction depth not so drastically improved		
Foolproof	Similar	-	Similar	-
Visibility	Very Good	Lessened cognitive load in one page / Notifications showing necessary information in a neat format	Good	Notifications showing brief information about the contents
Understandability	Very Good	Intuitive interface / Notification contents presented in the first look / Similar information architecture with	Good	Intuitive interface / Notification contents presented in the first look

		the original LearnUs	Bad	Users anticipating a full-function might be frustrated / Information Architecture unlike the original service, requiring users to learn
Logicality	Similar	-	Similar	-
Consistency	Good	Notification page consistent	Good	Notification page consistent
Predictability	Very Good	Pressing notification doesn't erase others, but takes us to the page, and is left unmarked	Good	Pressing notification doesn't erase others, but is left unmarked
Simplicity	Application much lightweight and simple with less cognitive load			

Final Design Summary



Our design solution is the revised full-function mobile LearnUs application. It inherits all the functions the original PC LearnUs system has, but with revised information architecture, flow chart and mobile-native interface to enhance user experience. This design seeks to allow users to access the LearnUs system with ease even when they cannot use a PC.

Our previous user research suggested that users found the existing LearnUs system quite problematic. Convenience, visibility, and understandability was chosen as the top problems disturbing the user experience, and thus were our main targets for resolution. The overall interface refers to other various frequently used applications so that users would find the application easy to use at first glance. Users will easily and intuitively learn how to use our application even without the help of a long, complicated user guide. The main color scheme is based on royal blue, the Yonsei university's official color.

The dashboard page is our main page, with each course designated a color for easier differentiation. This color is further used in the calendar, to-do list, and notification page for consistency. In the course page, the board for the current week appears at the top of the list, making it scrollable up and down for previous or upcoming weeks. The calendar and to-do list page refers to the design of other applications so that the users will intuitively know how to utilize it. Notification page also refers to the design of social media applications for the same reason. Usability of the notification page is also revised so that the notifications do not disappear upon checking, but are left checked.

Prototyping Method

Adobe XD was used for prototyping under the format of iPhone XS (375*812). Adobe creative cloud function was used so that all team members could access the XD project to revise and review the design process real-time and simultaneously.

Evaluation Plan

Based on the completed prototype, we planned to conduct a user evaluation to find out whether the user experience is actually improved, or if any further revision needs to be done. We conducted the research on 8 people, 7 without experience in using the official LearnUs application, and 1 outlier with experience with the official LearnUs application. Users conducted the given critical use cases on both the original LearnUs application and our revised prototype and the data was evaluated and compared.

1. Testing protocols / Methods

Users were given specific critical use cases and will use our application accordingly. Their prototype demonstration was analyzed with 4 methods: thinking-out-loud (TOL), observation, interview, and system usability scale (SUS).

Users were given explanations and instructions about the user research, then were asked some general and grand tour questions. The users were then given 4 critical use cases, and worked through the process in both conventional mobile LearnUs application and our revised prototype, while verbally expressing what they are thinking inside their heads. After finishing the series of tasks given, they were asked some questions about their experience through the SUS method and interview. All these processes were recorded with video, which were utilized for our observation study. We seeked to draw qualitative data like the user's personal thoughts and experience while using the application through TOL and interview. Quantitative data such as success rate and fail rate were drawn from observation, and the system usability scale was used to quantify the overall user experience.

The user research were conducted in the following order:

1. Instructions
2. General Questions
3. Grand Tour Questions
4. Critical Use Case demonstration - Thinking out Loud (Original LearnUs app)
5. System Usability Scale check (Original LearnUs app)
6. Critical Use Case demonstration - Thinking out Loud (Revised prototype)
7. System Usability Scale check (Revised prototype)
8. Interview

2. Instructions for the users

Before going into the user test, users were given the following script, being informed about the context and the contents of this test and asked if they wish to comply:

This is a usability study of a newly designed mobile LearnUs application. It is intended to improve the current Yonsei mobile LMS(LearnUs) experience. In this study, you will be asked to perform specific tasks using the mobile prototype and tell us what you think.

We would like to video record this usability test and share the results with our team for the purposes of improving LearnUs mobile application. Retrieved research data will not be shared with anyone else.

Please check if:

[] you give us permission to record video and share it with the team.

[] you give us permission to quote any verbal statements you make during the test in our reports.

You are free to leave at any time.

If you end participation, all the research data will be discarded right away.

Please let us know as soon as possible if you have any questions or concerns.

Participant: _____ (Signature)

3. Critical Use Cases

Tasks the users performed were as following:

1. Check notification
 - a. push notification
 - b. notification tab
2. Check task management
 - a. calendar (upcoming events)
 - b. to-do list
3. Check course board
4. Check attendance

Same tasks were conducted on both the original LearnUs application and our revised prototype, then the success rate, fail rate, action counts, and user frustration of each stage were observed and assessed.

4. Questions to be asked

The general questions included the user's basic information like:

1. Age
2. Gender
3. Major

4. School year

The Grand Tour Question asked the users:

1. Have you checked LearnUs on your phone?
2. Have you used the LearnUs Mobile application?
3. When was the last time you used the website or app?
4. How often do you use the LearnUs website or app?
5. How much time do you spend on the app?
6. What do you use the website / app for? Which features do you use most?
7. How satisfied are you with the available workflows?
8. What are your expectations for LearnUs Mobile?
9. How do you usually manage/record your academic schedule?

During the TOL demonstration, users were asked to:

1. Perform the given tasks
2. Explain the thought process
3. Explain the reason why the user performed certain action

At the system usability scale check for the tasks, the questions asked were as following:

1. I think that I would like to use this [project] frequently.
2. I found the [project] unnecessarily complex.
3. I thought the [project] was easy to use.
4. I think that I would need the support of a technical person to be able to use this [project].
5. I found the various functions in this [project] were well integrated.
6. I thought there was too much inconsistency in this [project].
7. I imagine that most people would learn to use this [project] very quickly.
8. I found the [project] very cumbersome to use.
9. I felt very confident using the [project].
10. I needed to learn a lot of things before I could get going with this [project].

After all the processes are finished, users were interviewed with the questions such as:

1. How would you describe your overall experience with the product?
2. What did you like the most about using this product?
3. What did you like the least?
4. What, if anything, surprised you about the experience?
5. What, if anything, caused you frustration?
6. How frequently would you use this product?
7. What else do you wish more from the app?
8. How likely are you to refer to this app? Why or why not?

Description of the evaluation technique

The utilized evaluation techniques were user testing with specific critical use cases, system usability scale (SUS) survey, and interviews. As we want to compare the current official LearnUs application and the prototype that we made of a restructured LearnUs application, we asked the users to do the testing on both types. The testing was done through the following steps.

1. Instructions
2. General Questions
3. Grand Tour Questions
4. Critical Use Case demonstration - Thinking out Loud (Original LearnUs app/Revised prototype)
5. System Usability Scale check (Original LearnUs app/Revised prototype)
6. Critical Use Case demonstration - Thinking out Loud (Revised prototype/Original LearnUs app)
7. System Usability Scale check (Revised prototype/Original LearnUs app)
8. Interview

First, the users were given explanations and instructions about the user research, and then asked to sign the participatory agreement form. Then the users were asked some general and grand tour questions. The users then were given 4 critical use cases, asked to work through the process in both the conventional mobile LearnUs application and our revised prototype, while verbally expressing what they are thinking inside their heads. In order to reduce biased results based on the order of usage, half of the users were asked to test the conventional LearnUs application first, and the other half were asked to test the prototype first. After finishing the series of tasks given, they were asked some questions about their experience through the SUS method and interview. All these processes were recorded with video and utilized later on in our observation study. Through Thinking Out Loud and interview, we sought to draw qualitative data like the user's personal thoughts and experience while using the application. Through System Usability Scale, we sought to draw quantitative data such as success rate and fail rate and use the data to quantify the overall user experience.

A total of 8 users were tested, 7 users with experience in using the LearnUs system through the website but no experience in using the LearnUs application at all and 1 outlier that has experience with using the official LearnUs application.

Results of the study

We conducted both offline and online usability tests using Adobe XD prototype on the phone. The session captured each participant's navigational choices, task completion rates, comments, overall satisfaction ratings, questions and feedback. Each individual session lasted approximately one hour. Test order of two applications differed to prevent any biases that could possibly affect the testing results. A total of eight participants were involved in our usability test through May 22nd to May 26th. All participants were students at Yonsei University. We tried to select students that did not have experiences of using the existing LearnUs app to prevent any biases that might affect the testing results. The demographic is given in the graph below.

Participant Demographic

Participant	Age	Gender	Major	School Year
1	23	Female	Systems Biology	4
2	24	Female	Information Interaction Design	3
3	24	Female	Global Leaders College Korean Culture and Media	4
4	22	Female	Information Interaction Design	3
5	24	Male	Integrated Technology	4
6	25	Male	Industrial Engineering	3
7	24	Female	Human Environment & Design	4
8	26	Male	Creative Technology Management	3

Test participants attempted completion of the following tasks:

- Check notifications
- Check task management
 - Calendar (upcoming events)
 - To-do list
- Check course board
- Check attendance

Results

Task Completion Success Rate (LearnUs)

For the existing LearnUs app, all participants successfully completed Task 1 (check notifications). Seven of the eight (87.5%) completed Task 2 (check task management). All participants successfully completed Task 3 (check course board) and only 37.5% were able to complete Task 4 (check attendance).

Participant	Task 1	Task 2	Task 4	Task 5
1	O	O	O	△
2	O	O	O	O
3	O	O	O	X
4	O	O	O	△
5	O	△	O	O
6	O	O	O	O
7	O	O	O	△
8	O	O	O	X
Success	8	7	8	3
Completion Rates	100%	87.5%	100%	37.5%

Task Completion Success Rate (Prototype)

For our prototype, all participants successfully completed Task 1, 2, 3, 4. The number of tasks is different from that of LearnUs because there was a new task for the To-do List, which is a new function of our application. Compared to the LearnUs app, users showed an improvement in the completion rate.

Participant	Task 1	Task 2	Task 3	Task 4	Task 5
1	O	O	O	O	O
2	O	O	O	O	O
3	O	O	O	O	O
4	O	O	O	O	O
5	O	O	O	O	O
6	O	O	O	O	O
7	O	O	O	O	O
8	O	O	O	O	O
Success	8	8	8	8	8
Completion Rates	100%	100%	100%	100%	100%

SUS (System Usability Scale) Results

The System Usability Scale (SUS) was created by John Brooke in 1986, who created a “quick and dirty”, reliable tool for measuring the usability. It consists of a 10 item questionnaire with five response options for respondents, from Strongly Agree to Strongly Disagree. The SUS has been tried and tested throughout almost 30 years of use, and has proven itself to be a valid method of evaluating the usability compared to industry standards. After task session completion, participants were asked to rate the two applications according to the SUS.

SUS Results for LearnUs

The agreement ratings for odd-numbered questions, which are all in a positive tone, were mostly below 50%. More than half (62.5%) agreed that most people would learn to use this app very quickly, which was due to the fact that the target users are university students who are very experienced at operating applications according to the interview conducted afterwards. The agreement ratings for even-numbered questions, which are in a negative tone, was mostly low. However, more than half (62.5%) agreed that the app was very cumbersome to use.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean Rating	Percent Agree
I think that I would like to use this app frequently	1	3		3	1	1.6	50%
I found the app unnecessarily complex		2	3	3		1.7	37.5%
I thought the app was easy to use		3	3	2		1.5	25%
I think that I would need the support of a technical person to be able to use this app.	2	4		2		1.2	25%
I found the various functions in this app were well integrated.		2	4	2		1.6	25%
I thought there were too much inconsistency in this app.	3		2	2	1	1.5	37.5%
I imagine that most people would learn to use this app very quickly.		2	1	5		1.8	62.5%
I found the app very cumbersome to use		1	2	4	1	1.9	62.5%
I felt very confident using the app.		2	3	3		1.7	37.5%
I needed to learn a lot of things before I could get going with this app.		4	2	2		1.5	25%

*Percent Agree (%) = Agree & Strongly Agree Responses combined

SUS Results for Prototype

The agreement ratings for odd-numbered questions, which are all in a positive tone, mostly scored very high. 87.5% agreed that they would like to use this app frequently, thought the app was easy to use, and imagined that most people would learn to use this app very quickly. All (100%) agreed that various functions in this app were well integrated, while 75% agreed that they felt very confident using the app. The agreement ratings for even-numbered questions, which are in a negative tone, were all 0%.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average Rating	Percent Agree
I think that I would like to use this app frequently			1	5	2	2.2	87.5%
I found the app unnecessarily complex	2	5	1			1	0%
I thought the app was easy to use			1	3	4	2.3	87.5%
I think that I would need the support of a technical person to be able to use this app.	4	4				0.8	0%
I found the various functions in this app were well integrated.				4	4	2.4	100%
I thought there were too much inconsistency in this app.	3	4	1			0.9	0%
I imagine that most people would learn to use this app very quickly.			1	2	5	2.4	87.5%
I found the app very cumbersome to use	2	6				0.9	0%
I felt very confident using the app.			2	4	2	2.1	75%
I needed to learn a lot of things before I could get going with this app.	2	6				0.9	0%

*Percent Agree (%) = Agree & Strongly Agree Responses combined

SUS Score Calculation

Each response is assigned a value for the SUS score calculation. The points breakdown for the responses are:

- Strongly Disagree: 1 point
- Disagree: 2 points
- Neutral: 3 points
- Agree: 4 points
- Strongly Agree: 5 points

The overall SUS score can be calculated by using the following framework:

- Add up the total score for all odd-numbered questions, then subtract 5 from the total to get X.
- Add up the total score for all even-numbered questions, then subtract that total from 25 to get Y.
- Add up the total score of the new values X+Y and multiply by 2.5

By following the scoring tabulation methodology above, the maximum SUS score is 100. This is not a percentage score but a total score out of 100. The average SUS score is 68, and scoring above or below the average will give you immediate insight into the overall usability of the design solution. Based on the research, a SUS score above a 68 would be considered above average and anything below 68 is below average. Scores below 68 indicate that there are issues with the design that need to be researched and resolved, while scores higher than 68 indicate the need for minor improvements to the design.

SUS Score Comparison of LearnUs and Prototype

Participant	LearnUs SUS Score	Prototype SUS Score
1	80	92.5
2	47.5	90
3	42.5	82.5
4	35	95
5	42.5	75
6	67.5	80
7	60	70
8	42.5	72.5
Average	52.2	82.2

Although SUS scores do not provide insight into specific problems, it does provide feedback on the overall ease of use of an app from a user's perspective. The average SUS score for LearnUs was 52.5 with only one participant scoring above 68. This indicates that there are issues with the design that need to be researched and resolved and strengthens the need for a redesigned LearnUs. The average SUS score for our prototype was 82.2 with no participants with a score under 68. This indicates that there is only a need for minor improvements to the design.

Findings

In the following section, we have detailed our major findings and recommendations for improving our prototype's usability. We have included quotes from our participants, who are listed as by number.

Finding 1. Participants liked the revised Calendar and the added To-do list and Timetable function.

When asked what participants liked least about the original LearnUs app, three participants (Participant 4, 5, 6) answered that they liked the calendar function least.

“The calendar was the most frustrating for this app because it looks like some kind of bad coding. I hate how each of the things are worded with red fonts like some kind of error message, and it is not in a calendar form, but just a listed form without any organization at all. Instead of showing it on the deadline date, it shows it on each of the pages(dates) so that it looks like it’s the same page for the different dates, so you can’t see the difference of which assignment is due when.” – Participant 4

“I don’t understand why the calendar was made that way. It’s really not intuitive. I don’t understand why it is necessary to have all events written down from the start date to the due date. If all events are shown daily, is there a reason why it’s a weekly calendar?” – Participant 5

On the contrary, four participants (Participant 2, 3, 4, 6) pointed out the calendar function of our prototype as the most liked function.

“I liked the calendar function because it was like it’s a combination of three apps right now. It’s got LearnUs, Everytime, and To-do app as well.” – Participant 1

“I like how the calendar lets you see all the assignments in terms of a wholesome view and the to-do list lets you check off the assignment and the small tasks that we need.” – Participant 4

“I feel like the inconvenient aspects were improved in the prototype. I like the timetable and calendar. Since I can add events, I think it would be convenient to put my study schedule here.” – Participant 6.

The timetable and to-do list functions were also mentioned as the most liked function by several participants.

“This(to-do list and calendar) is like a must! If we have this, and if we have the timetable, we don’t even need Everytime. I’m so excited.” – Participant 3

From the interviews, we could observe that participants definitely felt the improvements in the revised calendar and the added to-do list and timetable function.

They felt that our revised LearnUs could be used to replace and integrate different apps like a separate calendar app or Everytime that they used to manage their schedule.

Finding 2. Participants liked the color-coded classes, but they wanted more customization.

Many participants pointed out the color-coded classes as a positive aspect of our prototype. They commonly said it allowed them to distinguish classes easily.

“I like these colors because they’re pastel and clean. I like the fact that it has colors, not just blue and white, which is every Yonsei app. And I think colors make it easier to distinguish between things” – Participant 1

“It was right to the point. Especially with the color codes, it was easy to see your classes and differentiate them.” – Participant 3

However, there were recommendations for minor improvement. One participant pointed out that the pastel colors might be inconsistent with the main theme of the app.

“If I really, really think about inconsistency, like the sticker color for the classes, like the pastel color, and the overall tone for the app is a little bit different.” – Participant 2

Also, there were some opinions that they would like to have color customization. Since each person assigns different importance to different colors, the designated colors might not be to the liking of some people.

“My least favorite class and my favorite color? That’d be kind of sad.” – Participant 2

“Each person would have different opinions on the importance of a certain color, so I think it would be a good idea to let people designate colors by themselves.” – Participant 6

“Is there customization for color?” – Participant 7

Moreover, customization for the timetable function was also mentioned. The reason why many students use the Everytime app is because the timetable is customizable and they can add extracurricular events to it. If the timetable function of our app is customizable, there were opinions that they would not feel the need to use Everytime app.

“Can we add items to the timetable? I have part-time jobs that I want to add to the timetable, and if that function is there, I think I wouldn’t use Everytime.” – Participant 6

Recommendations for customization will be reviewed in the next section, and we will decide whether to apply it in improvement.

Finding 3. Participants wanted indications for finished tasks.

In our prototype, we put check boxes next to the to-do list tasks so that users can check off tasks when finished. However, some participants pointed out that this function was not linked to the calendar function. Also, there were opinions that indications other than check boxes are more intuitive, like being crossed out or changing color.

“What happens back on the calendar when you finish a to-do task? I want it to be crossed out or change color.” – Participant 1

“So I like the fact that it crosses out. But I think it would have been better if not checkbox, but you also cross this out like this. I think it’s because I’m used to Notion.” – Participant 2

Recommendations for indication of finished tasks will be reviewed in the next section, and we will decide whether to apply it in improvement.

Finding 4. Participants liked that there were only the necessary functions, but some wanted all functions of LearnUs web.

One large difference between our prototype and the LearnUs app is that there is a message function in the navigation bar of the LearnUs app while the function is taken out in our prototype. Many participants agreed that the function lacked importance to be placed in the navigation bar.

“I think it (LearnUs app) lacks inconsistency in that people will not use the functions in the navigation bar with similar frequency. I don’t understand why the message function is there. I would rather use Email to communicate with the professor.” – Participant 5

However, some participants did feel the need for the function to be included somewhere in our prototype.

“Where’s the message feature? there’s no message! I used it really well for group assignments. Maybe it’s not that important but you can put it in settings. I don’t think it’s that important to go into the navigation bar.” – Participant 2

“If students mainly use the app, they should be able to use all functions of the LearnUs web. You don’t know what will happen. Maybe there will be a need to message the professor or TA through the app.” – Participant 6

Recommendations for implementation of message function will be reviewed in the next section, and we will decide whether to apply it in improvement.

Finding 5. Participants like the revised notification because they like to grasp information at a look.

Many participants felt frustrated with the notification of LearnUs app because it did not include enough information on what it is about.

“Notification, not telling me what it is about? And you know, they will always be there like, and giving me alerts about the things that I don't care.” – Participant 2

“Hmm maybe how I can't clearly see which notification is for which class? Like I have to look really carefully.” – Participant 4

Therefore, in the prototype, we could observe that the participants were satisfied with the revised notifications that provided information about the class, type, and content of the notification.

“I guess if it's the prototype version (that I would recommend) because it gives really clear notifications, this would be really helpful.” – Participant 2

However, one participant pointed out a problem with predictability. There are many types of notifications, such as a file uploaded, or a class announcement which lead to different results. Participant 2 said that it would be helpful if users were given an option whether to see the post or download the file right away.

“I will tap this and, I guess it would lead me to the file week seven. Oh, wow. Okay, I didn't expect it to open a file right away. I thought it would show me the notice and stuff. of and the file would be underneath, or I guess, it downloaded it already. It's just another convenient way. But if it was, like, if the professor included some details about it, some explanations, and I would have not been, not want to see it this way, I guess.” – Participant 2

Recommendations for notifications are reviewed in the next section, and we will decide whether to apply it in improvement.

Finding 6. Participants like the integrated attendance function but felt the need for improvement.

One important change that we made in the prototype was that we integrated the online and offline attendance, and even the automatic attendance function of Y-attend. Even before the usability test, two participants mentioned the need for an integrated attendance system when we asked participant's expectations for LearnUs mobile.

“I think there should be electronic attendance, like you know we have a separate app for that? I think they should link that to the LearnUs app so that we don't have to have 2 apps.” – Participant 3

“The attendance checking will be good as well, because I feel like instead of using Y-attend, if the system is good enough, it can substitute that app.” – Participant 4

Many participants liked the integrated attendance function because there wasn't a need to download a separate app for attendance, which significantly decreased workload and inconvenience.

“You guys combined the electric attendance? I liked it. I like the fact that you guys included this because you got out, install another app, just for this. Which is really too much. But the fact that you included it here, and I can even do the attendance, that's great. And you can see other classes through this navigation. I like it.” – Participant 2

“If you can do attendance, I think people would only use this app.” – Participant 6

However, there were also recommendations for improvement. One participant felt that it would be more convenient to put attendance separately on the navigation bar.

“I did think it would be nice to have the attendance check separately on the navigation bar? Because it did not take me that much of a while, but it did take me a split second to think about where the attendance may be, and for people that use Y-attend, it may be more convenient if it is just right there as soon as you open the app.” – Participant 4

Another participant pointed out minor changes that could be made to the user interface.

“I don't think this is very easily readable. Zeros and x's would be much better than letters. I think it would be more recognizable if you put the name of classes on the top. Also, I don't understand why the attendance button is here. It looks like a bad advertisement.” – Participant 1

Recommendations for implementation of message function will be reviewed in the next section, and we will decide whether to apply it in improvement.

Discussion/Interpretation of the Results

Implications

Overall, the participants preferred the new prototype more than the original LearnUs application, saying that it is more straightforward and convenient, with added functions. The

participants gave additional opinions on how to improve the application, and after discussion and organization we decided to apply the following.

Implication 1. Customization of the course colors.

Some of the users liked the overall pastel color that was used for the color-coding of the courses but there were others who wanted to have the choice to be able to choose the colors by themselves in the importance that they feel each color should match. We thought that this reason was greatly reasonable and thus decided to add the function. It was difficult to decide whether to put the customization in the main page, Timetable, or in the My Page. After discussion, we decided that my page would be the right page as it is a function for personal customization, and if the users do not see the need for personal customization, they would not have to click in to care about the function, thus lessening their confusion.

Implication 2. Customization of Timetable

There were also suggestions for the customization of the timetable. Users wanted to add their personal schedules to the timetable so that they could see their schedule in one look without checking another application. We decided to add the feature in the timetable in the My Page as it is the official timetable page. On top of the page, there will be a button for the users to add the additional schedules that they have. As we determined that adding of schedule is a one time thing, in order to reduce confusions, the option will not be available in the slide up timetable provided in the dashboard.

Implication 3. Indications for finished Tasks

The users liked how the to-do lists could be checked off with check boxes. However there were users who thought that it was insufficient and needed a stronger indication that the task was finished. Thus we implemented the idea of making the color of the checked off task to turn into a lighter shade of gray to clearly show that the task is completed. For the linkage to the calendar, we decided to not implement it as we thought it would cause confusion for the users who are accustomed to the conventional calendar applications. In common calendar applications, the past events do not get crossed out or greyed out but just stays there as it was before. As calendar is also used as a tool to look back to see the overall work and flow that the user has gone through, we thought it would be less confusing and more clear for the tasks to not be changed when it is checked off in the to-do list. Looking back for work previously not done can be done in the to-do list tab.

Implication 4. Addition of the message function

Although users agree that the message function is not that of an important function to have its own tab in the navigation bar, there are users who note the importance of it as there may be an emergency message, or can be used conveniently for group project discussions. Therefore we decided to add the message function into our prototype. On

where to put the function, we decided that the hamburger menu in each of the courses will be the right place as it is where it is currently in the LearnUs website. When there is a new message, the user will be notified through the notification tab.

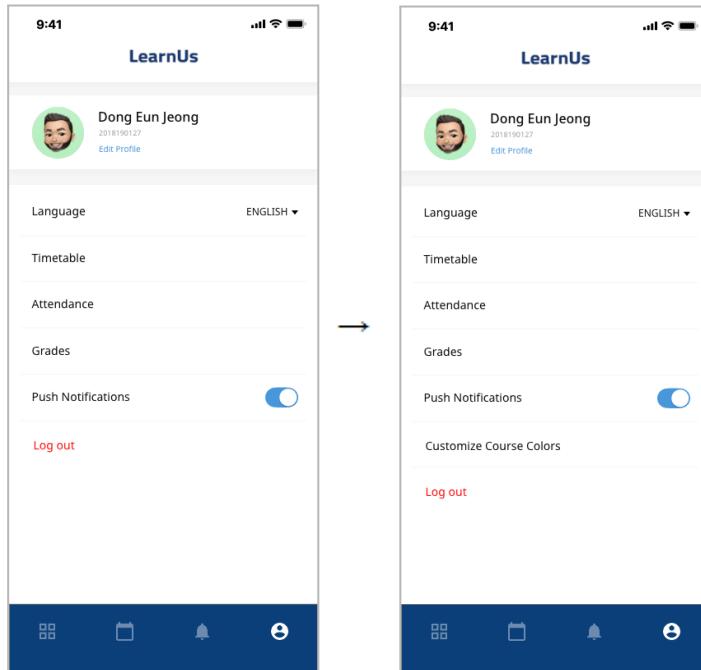
Implication 5. Minor change in marking attendance

A user stated that the attendance will be more easily readable if it was shown in Os and Xs instead of the original of letters (att. or abs.). We thought about it but realized that there are additional attendance options such as late and early leave. Thus we decided that Os and Xs can be only implemented in online attendance and the offline attendance has to be noted in letters such as (att. abs. late. ear.)

UI changes made

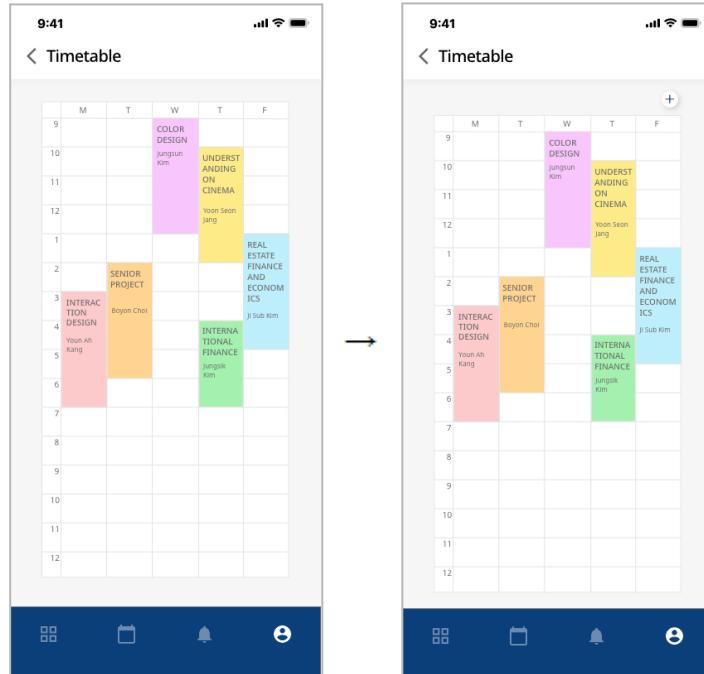
UI Change 1. Customization of the course colors.

An option to customize the course colors will be added to my page.



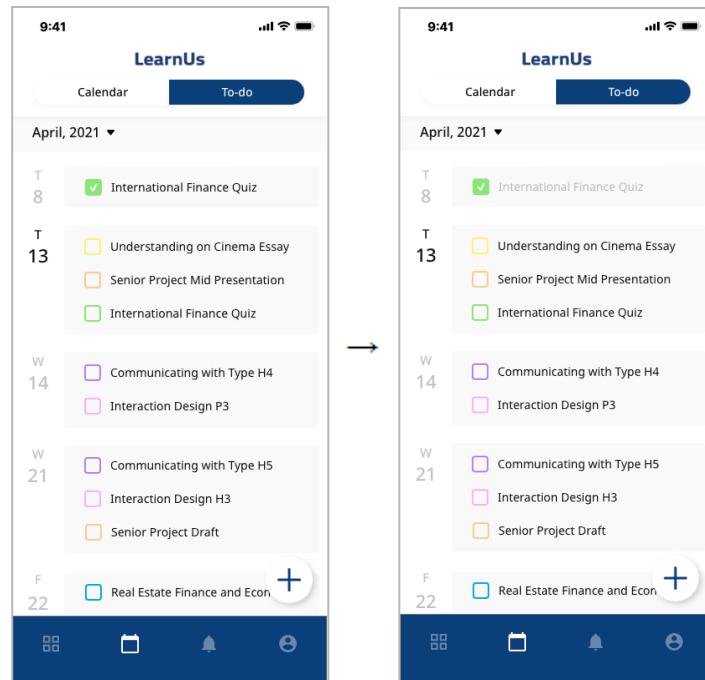
UI Change 2. Customization of Timetable

There will be an addition of the plus button on top of the timetable like the Everytime application that the users are accustomed to.



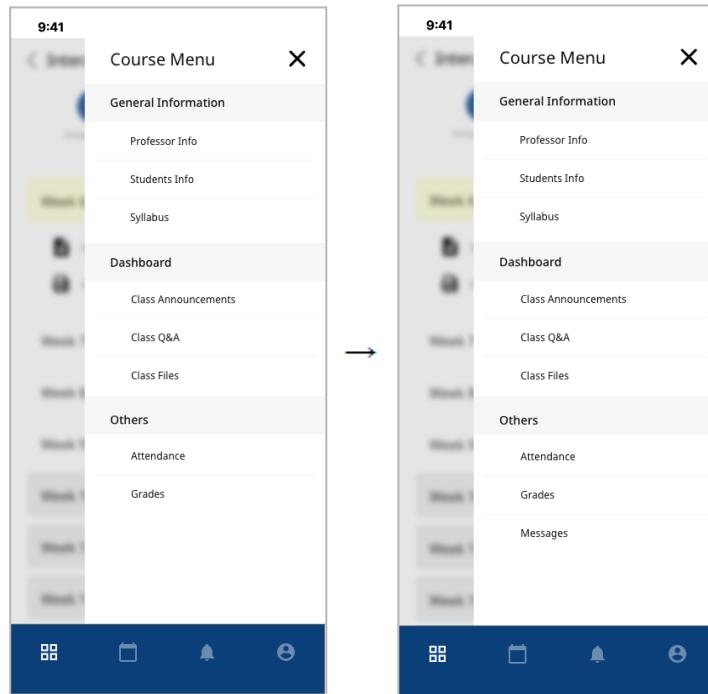
UI Change 3. Indications for finished Tasks

The checked task will turn into a light gray text to indicate that it has been finished.



UI Change 4. Addition of the message function

Message function is added to the hamburger menu in each course.



Changes that could be made in the future

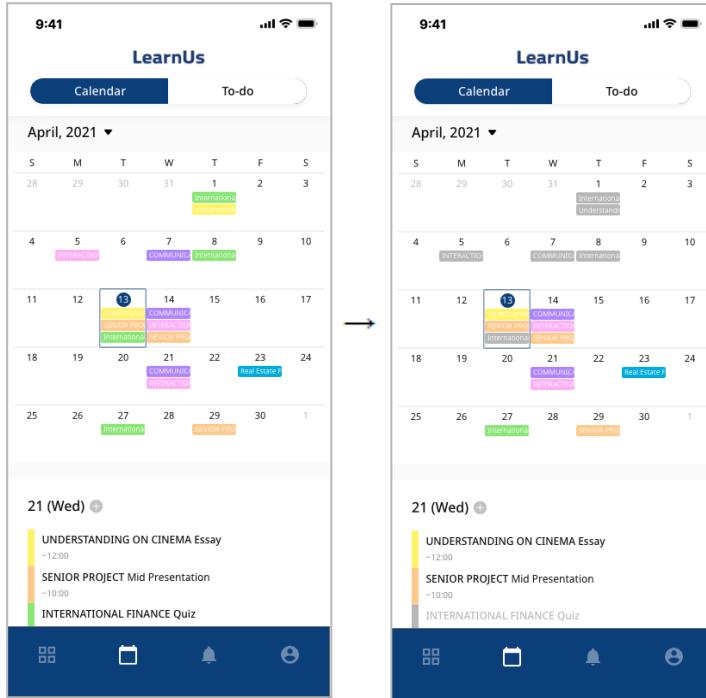
Possible Change 1. Attendance button placement

There were opinions on where the attendance button should be. A user stated that the current location looks like a bad advertisement, and another user suggested for it to be in the navigation bar. As there was a 100% success rate in checking the attendance, we think it is not a great problem now. However, in order to improve the user experience, more research and discussion of where to locate the attendance button needs to be done.

Possible Change 2. Shading of finished tasks in calendar

As mentioned above, there were opinions of making the finished tasks in the to-do list also show in the calendar. Although we decided to not implement it as we thought it may create confusion for users who are accustomed to the conventional calendar applications, we think we can do further research to make the design not confusing and thus satisfy the needs of both types of users. We tried various methods such as crossing out the tasks in the calendar with a line, or lowering the opacity of the colors. After various trials, we decided that making the finished task become a lighter shade of gray is the best method if we were to implement it. However there were minor issues regarding the design as the gray shade overlaps with the plus button and users may not be used to the design.

In addition, although we made it so that a lot of the functions exist in the application, we did not get to visualize some of the functions yet. If we further develop the application, we will visualize all of the functions that will be needed.



Reflection on User Testing

For prototyping testing, the participants were gathered from our team's surroundings therefore they were all juniors or seniors. Participants from lower grades would have brought diverse opinions and sights when analyzing the prototype usability.

In addition, there was an outlier in the participants of our testing. We tried one test on a user who has had previous experience with using the official LearnUs application. However after that testing, we clearly found out that there is a bias in viewing the applications so we decided to do the rest of the testing on participants who do not have experience in using the official LearnUs application. The results could have been compared if more results of the people who have used LearnUs application before were recorded.

During the Thinking Out Loud session, the participants were supposed to speak more, but the process and expectations were not informed well. The reactions and thoughts of participants were not recorded much, so an improved Thinking Out Loud session would have led to better collection of results.

What we learned from the project

We used to think that user experience was a vague concept, but we learned that there's a systematic research method for it. Although it's a relatively new concept, there were interesting principles that we could apply in our process.

Teamwork was smooth for user research, but it was harder for prototyping because a division of work within the prototyping process could lead to an incoherent design outcome. Since no more than one person could work on design at once, we had to work in relay with one as a leading role. Although it was hard to balance the workload, we tried our best to allocate a similar workload for each person. Even when the same amount of work could not be allocated for 1 part of the project, we would balance it out in the next, and all members were willing to do the work. Overall, our team had great teamwork. We had fruitful and efficient discussions and all of the members were always willing to help each other out when needed, thus lessening the burden.

Through our experiences, we learned that although UI design may look simple and easy on the surface, even the smallest changes can change the user experience. We thought this was very interesting and did various trials of different designs in order to get the best UI/UX.

Since LearnUs web and app are relatively new systems, they kept on updating even in the middle of our research. We felt that it was hard to work with a contemporary issue. If we were to start again, we would be able to research the most updated and stable version of both the LearnUs website and application and thus get more insight on how to design and improve our prototype for the LearnUs application.

In addition, if our team were to start the project once again, we would consider using Figma instead of Adobe XD as the prototyping medium, because Adobe XD had some technical limitations whereas Figma operates more smoothly. Figma operates better in an online environment while Adobe XD operates the best when the mobile is physically connected to a PC. Such technical limitations of Adobe XD hinders spontaneous prototype testing.

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APPENDIX

Interview Questions

시작하기에 앞서, 녹화 및 녹음해도 괜찮은지 여쭤보고 싶습니다. 동의하실 시 본 자료는 프로젝트 수행 목적으로만 사용되며, 영상 자체는 교수님 및 조교님들께만 보여질 것을 약속드립니다.

먼저, 저는 _____입니다. Interaction Design이라는 수업의 일환으로 이 리서치를 진행하게 되었습니다. 참여 의사를 밝혀주시고 시간 내주셔서 정말 감사드려요.

어떻게 인터뷰가 진행될지 간략히 말씀드리자면, 세션을 진행하며 몇 가지 질문을 드리고, 그 이후 런어스에 접속해서 task를 드릴 예정입니다.

인터뷰 시작하겠습니다.

Before the interview, I would like to ask for your permission for recording. If you agree, we promise that the recording will only be used for project purposes, and the recordings will only be shown to professors and assistants.

I'm ____ of Interaction Design class of Yonsei University, conducting this research. Thank you for your willingness in participating in this research.

To briefly inform you how this interview will take place, we will give you questions regarding your previous survey answers, and then give you tasks using LearnUs.

Now we'll start the interview.

[기기사용 질문/Questions on Devices]

1. 이전 설문에서 답하셨던 각 기기 사용빈도에 대해서 설명해주세요

Referring to previous survey results, please explain the usage frequency on each device.

2. 공부라는 과정안에서 각 기기를 어떻게 사용하시나요?

How do you use each device in the studying process?

3. 컴퓨터 런어스에서 가장 많이 사용하는 기능 / 만족도에 대한 이유

What is the most used function in computer LearnUs? Are you satisfied? Reasons?

4. 태블렛 런어스에서 가장 많이 사용하는 기능 / 만족도에 대한 이유

What is the most used function in tablet LearnUs? Are you satisfied? Reasons?

5. 핸드폰 런어스에서 가장 많이 사용하는 기능 / 만족도에 대한 이유

What is the most used function in phone LearnUs? Are you satisfied? Reasons?

6. 이전 설문 대답의 런어스 기능별 중요도 / 만족도에 대해서 설명바람

Please explain your answer on function importance and satisfaction.

7. 평소 과제들을 어떻게 관리하시나요? 어떤 기능을 사용하시나요?

How do you manage assignments? What functions do you use?

8. 런어스에 접속한 후, 수업 접속, 공지사항 확인, 과제 제출, 수업 자료를 다운받아주세요

How do you log into LearnUs, go into class, check announcements, submit assignments, and check class materials.

9. 런어스 개편 방향에 대해서 할 말이 있으신가요

Do you want to say anything for future LearnUs updates?

Survey Questions

1. 현재 몇학년이신가요? Which year are you currently in?

- 1학년 Freshman
- 2학년 Sophomore
- 3학년 Junior
- 4학년 Senior
- 기타 others

2. 런어스(LearnUs) 사용 경험이 있으신가요? Have you used LearnUs before?

- 예 Yes
- 아니오 No

3. 평균적으로 하루에 몇번 컴퓨터(노트북, 데스크탑)로 런어스에 접속하시나요? On average, how many times a day do you use your computer (laptop, desktop) to access LearnUs?

- 0번
- 1번
- 2번
- 3번
- 4번
- 5번
- 6번
- 7번
- 8번

- 9번
- 10번 이상

4. 평균적으로 하루에 몇번 핸드폰으로 런어스에 들어가시나요? On average, how many times a day do you use your phone to access LearnUs?

- 0번
- 1번
- 2번
- 3번
- 4번
- 5번
- 6번
- 7번
- 8번
- 9번
- 10번 이상

5. 평균적으로 하루에 몇번 태블릿(아이패드, 갤럭시탭 등)으로 런어스에 들어가시나요? On average, how many times a day do you use your tablet(iPad, Galaxy Tab) to access LearnUs?

- 0번
- 1번
- 2번
- 3번
- 4번
- 5번
- 6번
- 7번
- 8번
- 9번
- 10번 이상

6. 아래 기기로 런어스를 사용했을 때의 만족도를 매겨주세요 Please rate the satisfaction of using LearnUs with the device below.

	매우 만족 Very Satisfied	만족 Satisfied	보통 Average	불만족 Unsatisfied	매우 불만족 Very Unsatisfied	사용해본 적 없음 Not tried before
컴퓨터 Computer						
핸드폰 Phone						
타블렛 Tablet						

7. 아래 런어스 기능의 중요도를 알려주세요 Please let us know the importance and satisfaction of the LearnUs function below.

	매우 중요함 Very Important	중요함 Important	보통 Average	중요하지 않음 Not important	매우 중요하지 않음 Not important at all
알림 Notification					
강의 시청 Watching lectures					
출석 Attendance					
게시글 Posts					
과제 제출 Assignment Turn-in					
성적 확인 Grade Check					
디스커션 Discussion					
강의 시간표 Timetable					
달력					

Calendar					
퀴즈 Quiz					

8. 아래 런어스 기능의 만족도를 알려주세요. Please let us know the importance and satisfaction of the LearnUs function below.

	매우 만족 Very Satisfied	만족 Satisfied	보통 Average	불만족 Unsatisfied	매우 불만족 Very Unsatisfied	사용해본 적 없음 Not tried before
알림 Notification						
강의 시청 Watching lectures						
출석 Attendance						
게시글 Posts						
과제 제출 Assignment Turn-in						
성적 확인 Grade Check						
디스커션 Discussion						
강의 시간 표 Timetable						
달력 Calendar						
퀴즈 Quiz						

9. 런어스를 쓰면서 경험했던 불편함을 골라주세요 (다중선택) / Please choose any inconvenience you experienced while using LearnUs. (Multiple Choice)

- 로그인 관련 문제 (ex. 아이디 저장 안 됨, 강제 로그아웃 등) / Login related issues (ex. ID not saved, unintended logout, etc.)

- 접속 방법의 어려움 (ex. 도메인 입력, 즐겨찾기, 런어스 검색 등) /
Difficulty of access
- 불안정한 서버 / Unstable server
- 지속적으로 뜨는 팝업 / Continuous Pop-Ups
- 직관적이지 않은 인터페이스 / Unintuitive Interface
- 알림 관련 문제 (ex. 알림을 하나만 눌러도 알림 전체가 사라짐, 알림
가시성이 멀어짐 등) / Problems with Notifications (ex. All alerts disappear
with just one click, low notification visibility etc.)
- 강의 영상 시청 관련 문제 (ex. 동영상 강의 배속 제한, 동영상 오류, 영상
시청 경과 확인 불가능 등) / Problems with watching lecture videos (ex.
restrictions on the speed control of video lectures, video errors, inability to
check the progress of video, etc.)
- 출석 체크 관련 문제 (ex. 온/오프라인 출석 구분 불명확, 출석 여부 확인
힘듦 등) / Problems related to attendance check (ex. Online/offline attendance
classification unclear, difficulty of checking attendance, etc.)
- 과제 제출 관련 문제 (ex. 과제 파일 형식 오류, 업로드 시 버튼 두번 클릭
필요 등) / Issues related to task submission (ex. task file format error,
double-click required for upload, etc.)
- 기타 Others

10. 추가적으로 런어스를 개선하기 위한 요구사항이 있다면 적어주세요.
(선택) / Please write down any additional requirements to improve LearnUs.
(Optional)

11. 추첨을 위한 핸드폰번호나 카카오톡 아이디를 남겨주세요. (선택) / Please
leave your cell phone number or Kakao Talk ID for the raffle. (Optional)

Prototype User Evaluation Interview Guide

Before going into the user test, users were given the following script, being informed about
the context and the contents of this test and asked if they wish to comply:

This is a usability study of a newly designed mobile LearnUs application. It is intended to improve the current Yonsei mobile LMS(LearnUs) experience. In this study, you will be asked to perform specific tasks using the mobile prototype and tell us what you think.

We would like to video record this usability test and share the results with our team for the purposes of improving LearnUs mobile application. Retrieved research data will not be shared with anyone else.

Please check if:

you give us permission to record video and share it with the team.

you give us permission to quote any verbal statements you make during the test in our reports.

You are free to leave at any time.

If you end participation, all the research data will be discarded right away.

Please let us know as soon as possible if you have any questions or concerns.

Participant: _____ (Signature)

General Questions:

1. Age
2. Gender
3. Major
4. School year

Grand tour questions:

- Please explain your overall LearnUs Experience
- Have you checked LearnUs on your phone?
- Have you used the LearnUs Mobile application?
- When was the last time you used the website or app?
- How often do you use the LearnUs website or app?
- How much time do you spend on the app?
- What do you use the website / app for? Which features do you use most?

- How satisfied are you with the available workflows?
- How do you usually manage/record your academic schedule?
- What are your expectations for LearnUs Mobile?

Thinking Out Loud:

1. Perform the given tasks
2. Explain the thought process
3. Explain the reason why the user performed certain action

SUS Survey:

1. I think that I would like to use this app frequently.
2. I found the app unnecessarily complex.
3. I thought the app was easy to use.
4. I think that I would need the support of a technical person to be able to use this app.
5. I found the various functions in this app were well integrated.
6. I thought there was too much inconsistency in this app.
7. I imagine that most people would learn to use this app very quickly.
8. I found the app very cumbersome to use.
9. I felt very confident using the app.
10. I needed to learn a lot of things before I could get going with this app.

Interview Questions:

1. How would you describe your overall experience with the product?
2. What did you like the most about using this product?
3. What did you like the least?
4. What, if anything, surprised you about the experience?
5. What, if anything, caused you frustration?
6. How frequently would you use this product?
7. What else do you wish more from the app?

8. How likely are you to refer to this app? Why or why not?