

## **Deliverable B Group C2.4**

Ali Elmawazini: 300317827

Zeyu Shao: 300166803

Ryley MacWilliams: 300263961

Omar Muslat: 300066154

Orel Benkarmona: 300160407

Giovanni Abruzzo: 300233180

January 29<sup>th</sup>, 2023



### **Abstract**

*This is a document that presents the development of the problem definition and the development of concepts for a mouse skill application. Included in this document is a list of the user needs, the problem statement, benchmarking, development of metrics and a couple of concepts. This document will also describe the method used to develop these concept ideas and a sketch of every concept. Overall, the document will compare concepts in order to identify the most adequate design of a mouse skill application.*

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## 1. Introduction

The team was tasked with developing an application that will introduce mouse operations to users inexperienced in using a mouse. Keeping practicality in mind, the team wanted to combine everyday tasks such as browsing social media, navigating Outlook, and Netflix by first introducing the user to the main mouse operations such as: Right-click, left-click, drag and drop. On another note, the main user base of the product will be people between the ages of 18 - 70 years that have disabilities such as cerebral palsy. Users will have access to hardware that fits their accessibility needs. However, there is no product on the market that helps these users understand the various mouse operations using mature content. In order to be able to deliver the product, it is important to first analyze the demands of the customer, followed by conceptualizing the desired product. The envisioned product will be compared to existing products that meet the target specifications. Finally, a sketched out global concept will be created in order to receive feedback from the upcoming client meeting.

## 2. Client Statements:

Table I: Client statements

Number of statements	Client Statements
1	Our core values are respect, dignity and empowerment.
2	About 75% of our users have Cerebral Palsy.
3	Some users have epilepsy.
4	The goal is for the user to learn basic mouse skills therefore it can not be too complicated (ensure the teaching of mouse commands as well such as copy/ paste).
5	Do not make the application too childish (content wise ie. Dora is bad) as it is mainly developed adults using the product.
6	Try to involve user interests like animals or sports (hockey).
7	The ideal outcome is that the users are now able to use programs such as TinkerCAD, Canva, Microsoft Word, Outlook (emails), Facebook, Netflix and other social media/ entertainment with ease.
8	Program should be designed for a standard mouse (left click, right click, middle mouse button and scrolling features).
9	If possible (time allowing) create some sort of strap that enables CP users to not worry about fully gripping the mouse at all times.

Number of statements	Client Statements
10	Contrast enhancing elements would be beneficial for most users as some have visual impairments too (add this as part of a UI).
11	Prefers the app to be done in Java coding but ultimately it doesn't matter.
12	One way you could avoid failing in app creation is by empathising with the potential user and putting yourself in their shoes.
13	Users lack mouse skills.
14	Customer needs something to help the user understand and use mouse buttons.
15	Users love doing cards on the computer by 3D printing or using other software's.
16	Sometimes the customer needs to drag and click on stuff with the mouse because the users are unable to use the mouse in some situations.
17	Having a through step-by-step course type of application would help the users.
18	Videos demonstrating some actions will allow the user to better understand tasks.
19	Having a non childish game with rewards would encourage the user more and encourage them to use the application.
20	Audio is always a good aspect.
21	Most users do not have any mentally disabilities.
22	Visual representations are better than reading but have closed captioning.
23	Users may get stressed out when there is a time constraint that results in a failure or closing of the program if the work is not accomplished.
24	Try to avoid a test like program

Number of statements	Client Statements
25	Users do not like the childish rewards like “OH YAY YOU DID IT!”, do not belittle them or their dignity, try to respect and empower them instead.
26	The main goal is to teach the user how to use a mouse.
27	If time allows, incorporate a module section that allows the users to practise a specific skill.
28	The application must be available on PC
29	Users will likely be using the app for 20-45 min a day.
30	Make sure there is a good UI that allows the user the ability to change contrast, text size and volume.
31	Overall technology proficiency is similar to grandparents (users know what they want to do, they just don’t know how to do it).
32	Start lessons from the bare bones absolute basics and progress slowly, however, allow users to skip parts they already know.
33	Add lessons where the user is not prompted on how to do things but add hint buttons to use if necessary.

### 3. Client Needs

In the table below, the client statements are respectively found in the previous section (section 2 Client Statements). With the client statements that the team has gathered from the first meeting with the client, we were able to interpret these statements into user needs. In *Table II*, the team has listed out our interpreted need statements based on the client statements.

*Table II: Users Need Statements*

Client statements	User need statements
1	The application does not diminish the capabilities of the user's mentality.
2	The control on the application minimises error when using a mouse.
3	The brightness of the application avoids any flashes.
4	The application provides simple explanations and instructions to easily guide the users through mouse manoeuvres.
5	The application is developed for the usage of an adult mentality.
6	The application has symbolism of sports and animals.
7	The application develops the foundation skills to properly use a mouse on a daily basis.
8	All the buttons on a standard mouse are used in the application.
9	The application is accommodated with a strap that can be attached to the mouse for enhancing the control of the device.
10	The application has white, yellow and black colours.
11	The application is built with Java language.
12	The application is respectful towards people with disabilities.
13	The application develops basic mouse skills
14	The application has instructions
15	The application can be used for people with disabilities



Client statements	User need statements
16	The application develops skills that can be used in daily computer activities
17	The application helps master basic mouse controlling skills
18	The application has step by step tutorials
19	The application contains video simulations of the tasks
20	The application has a reward system
21	There is audio in the tutorial videos
22	The application addresses adult users
23	The application has more visuals than text
24	The application can be open for a long period of time
25	The application is user-friendly
26	The application is built towards an adult audience
27	The application demonstrates the basic mouse skills
28	The application has module sections
29	The application has a save button or auto save feature.
30	The application has a well organised, accessible UI that allows optimal user comfort (colour contrast, text size, volume).
31	The application has clear instructions and teaches mouse basics.
32	The application needs no mouse knowledge to begin using.
33	The application has more complicated lessons with hint buttons.

### 3. Client Need Prioritization

From the Client Statements and Client Needs (*see Table I and Table II*), we are able to numerically express a prioritization for our clients' needs. The prioritization was created in collaboration with our client. By empathizing with their needs, and understanding the current limitations they are facing, we are able to prioritize the needs to implement into our future prototypes. *Table III* focuses on needs regarding accommodations, *Table IV* focuses on needs regarding the user interface, and *Table V* focuses on needs regarding the learning and content within our product. As well, we prioritized the needs according to the repetition of the need by our client during the meeting. For example, the need of having an application developed for an adult audience was prioritized as a 5 for us. Indeed, the client repeated multiple times that this was a crucial aspect that needed to be integrated inside the application because the users do not like to play games that are childish. Playing those games makes them feel incapable of completing a simple task.

*Table III: Client Need Prioritization for Accommodations*

Priority (1 = Least Important, 5 = Most Important)	Client needs - Accommodations
4	The brightness of the application avoids any flashes.
2	The application is accommodated with a strap that can be attached to the mouse for enhancing the control of the device.
3	The application has white, yellow and black colours.
5	The application can be used for people with different disabilities
4	The application contains video simulations of the tasks
4	There is audio in the tutorial videos

*Table IV: Client Need Prioritization for User Interface*

Priority (1 = Least Important, 5 = Most Important)	Client needs - User Interface
5	The application does not diminish the capabilities of the user's mentality.
5	The application is developed for the usage of an adult mentality.
2	The application is built with Java language.
4	The application has a well organised, accessible UI that allows optimal user comfort (colour contrast, text size, volume).
2	The application has a save button or auto save feature.
2	The application has module sections
5	The application is respectful towards people with disabilities.

*Table V: Client Need Prioritization for Learning/Content*

Priority (1 = Least Important, 5 = Most Important)	Client needs - Learning/Content
4	The application provides simple explanations and instructions to easily guide the users through mouse manoeuvres.
2	The application has symbolism of sports and animals.
5	The application develops the foundation skills to properly use a mouse on a daily basis.
5	All the buttons on a standard mouse are used in the application.
4	The application has step by step tutorials

2	The application has a reward system
4	The application needs no mouse knowledge to begin using.
2	The application has more complicated lessons with hint buttons.
2	The application can be open for a long period of time

## 4. Problem Statement

Design an application for Computer-Wise that teaches basic computer mouse skills for individuals with disabilities such as Cerebral Palsy. The application should present a number of tasks related to computer mouse manoeuvres that are easy to follow and simple to understand, while being directed towards an adult audience and having an empathetic approach.

## 5. Design Criteria and Metrics

The design criteria may change based on the needs prioritization.

The Mouse Skills applications must possess the following features:

- UI catering towards a more adult audience, but not too complex, as well as no flashing colours
- Guides' users through simple mouse functionalities, with visual, text, and speech instructions

In addition, the app should also, if possible, possess the following features:

- Module system where users are able to switch between modules of different mouse exercises (also maybe have a progress system)
- Difficulty scale between each module

Metric Number	Need Numbers	Design Criteria	Metrics	Units	Priority
1	1, 5, 12, 15, 22, 25, 26, 30	User interface design complexity	Simplicity of user interface organisation	Rating # (1-5)	5
3	3	Transition time between different colours	Time response of colours	Seconds (s)	4
4	7, 8, 13, 16, 17, 24, 27, 31	Number of unique tasks	Quantity of tasks	# (Number of manoeuvres per objective)	4
5	1, 4, 5, 7, 12, 13, 17, 32, 33	Difficulty of each task	Rating of difficulty	Rating # (1-5)	5
6	30	Average font size	Pixels	Px (pixels)	3
7	10, 30	Number of different colours in the palette	Colour quantity	# Of colour	3
8	14, 18, 19, 20, 21, 24, 28, 29	Chapter separation	Number of modules	# (number sections)	4
9	N/A	Cost of application	Cost	\$	2
10	1, 5, 12	Directed audience	Age number	Number of years (#years)	4

## 6. Constraints and Requirements

### 6.1. Functional Requirements:

The functional requirements are aspects that our product has to do. Indeed, below there is a list indicating all functional requirements that are defined for this project. Also, we have determined these functional requirements by analyzing the user needs and the problem statement. However, these requirements can change according to the feedback from upcoming client meetings.

1. The application teaches basic mouse skills.
2. The application guides users to complete tasks.
3. The application tracks the user's progress.
4. The application switches to different exercise difficulty.
5. The application encourages users to improve their skills.
6. The application directs the users to practise skills depending on their level.
7. Product helps clients familiarize themselves with common mouse operations such as:
  - Point
  - Click: pressing and releasing a button (either one or two times in quick succession)
  - Right-Click
  - Drag
  - Scroll

### 6.2. Non-Functional Requirements

The non-functional requirements are characteristics such as quality attributes that the product has to be. Indeed, below, there is a list of non-functional requirements describing the product's attributes. These attributes were determined by analyzing the user needs and the problem statements. As mentioned in the functional requirements, some requirements might be changed depending on future client meeting feedback.

1. The application is directed to an adult audience.
2. The application is simple to use.
3. The application has different exercises.
4. The application has different modules.
5. The application has a quick response time.
6. The application is user-friendly.
7. The application is an educational program.
8. The application is specifically for utilizing mouse functions.
9. The application has a form of instructions.
10. The application is low cost.
11. The application has a reasonable font size.

### 6.3. Constraints

The constraints are the aspects that must be totally respected in the product. As such, a list of constraints about the product and about the project have been enumerated below. These constraints were derived by analyzing the user needs and the problem statement.

1. Time to design the project: due date April 3rd. The product should be designed and tested in around 3 months. In other words, the product needs to be feasible within the allotted time.
2. Budget: Product needs to be designed within the budget which is 50\$ while also being able to accommodate an influx of users (depending on if we take a cloud-based approach to host our app)
3. The application must develop and teach users the basic mouse skills for a computer.
4. The product must not diminish the user's abilities by containing childish themes.
5. The product must not degrade a user's physical or mental capabilities. This is to ensure that there is a returning user base and that the product reflects the client's core values (respect, dignity, and empowerment).
6. The application must be user-friendly and easy to use.
7. The application must have all the basic mouse manoeuvres integrated into the system for the users to practise.

## 7. Benchmarking

### **Windows built-in games (Minesweeper & Solitaire):**

Features:

- Apps did not need an internet connection to run.
- UI was simple and easy to understand.
- Solitaire: Helped people familiarize with the drag and drop concept
- Minesweeper: Helped with the right click and left click
- Game pre-installed.

Limitations:

- Users had to still access the window list of apps to access the games.
- It was primitive.
- No teaching element ie: No scalability
- Users could not translate this into navigating the web and knowing what each website used each mouse functionality for
- Don't come pre-installed anymore

### **Minimouse.us Mouse Skill Games:**

#### Features:

- Available for free online
- 16 different games, likely catering to different individuals.
- Intriguing game-like design
- Simple to understand UI.
- Ability to practise all functions of a standard mouse

#### Limitations

- ~7 advertisements on the screen
- All games cater towards young children.
- No game instructions
- Small fonts
- Repetitive actions

### **Aimlabs:**

#### Features:

- Available for free on steam (there is in game purchases, but they are all purely cosmetic)
- Many adjustable mouse settings (5 for basic, a lot for advanced tweaks)
- Eye-catching UI
- Many tasks/scenarios to help train your mouse movement (from easy to hard)

#### Limitations:

- Very complex UI design (hard to navigate will get lost)
- Caters towards first person shooter players.
- 

### **Merge Colour Blocks- Drag and Drop Puzzle:**

This application is free to download on Amazon.ca. In summary, the user of this application needs to drag blocks of different colours on a board. The goal is to match blocks of colours with one another in order to blast them away from the puzzle board. Hence, it practises mouse skills by training the user to drag objects of different colours on a board.

#### Features:

- Available for free to download.
- Quick and responsive for every click
- Hundreds of exercises
- All ages
- Size: 18.6MB
- 4½ stars review
- Simple and easy to use.

#### Limitations:

- Repetitive actions



- No tutorial instructions
- Bright colourful interface

### **Mouse Accuracy:**

Features:

- Available for free, it is web based.
- Adjustable settings for colour, cursor and difficulty
- Sleek and simple UI

Limitations:

- Only one task
- Built for measuring mouse accuracy.

*Table IV: Benchmarking table for mouse skill software*

Applications	User interface design complexity (Rating 1-5)	Transition time (s)	Number of unique tasks (# quantity)	Difficulty of tasks (rating 1-5)	Number of modules (#)	Different colours in the palette (# colors)	Age Recommendation (#)	Font size (# font)	Cost (\$)
1. Minesweeper and solitaire	2	1s	3	1	6	16	All ages	Can be varied	0\$
2. Minimouse.us	2	1s	4	2-3	16	~100	<12	Small ~10	\$0 +ads
3. Aimlabs	5	1s	infinite	1-5	infinite	4	>13	Can vary	\$0
4. Merge color blocks	3	1 s	2 (press and drag)	2	100 levels	6	All Ages	N/A	\$0
5. Mouse Accuracy	2	instant	1	1-4	1	4	All Ages	24px	\$0

Overall, Minesweeper and Solitaire is the best mouse skills software, it contains the different mouse functions, and it is simple without being child like. The next best one is Merge Color Blocks as it contains a decent number of tasks, is not too childish, and has some challenge involved. The third best would be Aimplabs, since it has so many different tasks that vary in difficulty, but because of the number of different tasks, the software is not too straightforward and navigation through the UI is pretty complicated. The fourth-best one would be Minimus.us, which is good in the sense that it covers all the basic mouse functions, but the design is targeted towards children. In the last place is Mouse Accuracy, which has a simple and non-childish UI, but lacks a variety of tasks, only having one task which is measuring the mouse accuracy of the user.

## 8. Target Specifications

The target specifications that we have decided as a team are based on the products that we have researched during benchmarking. Also, they are based on the realistic capabilities of the team to create a software application that will respect the user's needs and the problem statement.

Table V: Target specification values:

	User interface design complexity (Rating 1-5)	Transition time (s)	Number of tasks (# quantity)	Difficulty of tasks (rating 1-5)	Number of modules (#)	Different colours in the palette (# colors)	Age Recommendation Age (#)	Font size (# font)	Cost (\$)
Ideal target specifications	2	1s	3	2	5	4	>18 years	18	\$0
Marginal target specifications	<3 and >1	<2	<5	<3	<7	Between 3-6	>15 years	Between 14-20	\$0

We have decided to have an ideal target specification about the user interface complexity of 2 in order to respect the requirement of ease of use and because the best benchmarking products that we have benchmarked are of rating 2. However, we have put in place a marginal target specification of  $<3$  and  $>1$  meaning that we will accept attaining a user interface complexity of 3 but not more. As for the transition time, we have concluded that the ideal target specification should be 1s since all the products have this value. As for the marginal value, we decided to have a transition time of not more than 2s. For the number of tasks, we decided that an ideal value should be 3 tasks and a marginal value should be fewer than 5 tasks because, in order to test all the basic skills of the client, we need to make them do tasks such as the basic skill for manoeuvring a mouse. As for the number of modules, we decided that an ideal value would be 4 and a marginal value would be between 3 to 6. We decided on those values depending on the time constraint that the team has to create these exercises and modules. As for the recommended age, we have decided that an ideal value of 18 years old and a marginal value of more than 15 years old. Indeed, the client specified that they need an application directed to a matured age and not children level. As for the font size, we have based our judgment on the benchmarking values. Thus, there would be an ideal value of 18 and a marginal value between 14 and 20. Finally, since the cost was benchmarked as a metric, we decided that an ideal value should be \$0 the same for the marginal value because all the benchmarked products were free.

## 9. Subsystems:

### 9.1. Subsystem 1: Tutorials

For concept 1 of subsystem 1, it will have an optional tutorial video before every single exercise for the user to watch if they want (the tutorial defaulted to play and users can skip). The tutorial videos will be stored in a database and retrieved from said the database when needed.

For concept 2 of subsystem 1, it will have tutorials that will come in video form with a video of the screen as well as someone's hand on a standard mouse to show which buttons are being pressed and when. The user will be prompted to watch the tutorial when he/she is stuck on a level for 4 times the normal length of time. This being said, the user can bring up the tutorial at any time by clicking on the lightbulb icon.

For concept 3 of subsystem 1, at the start of each lesson there will be a 3D model of a hand that will demonstrate the exercise (for example if we were trying to make the user do a right-click, a hand will appear holding the mouse and the side of the mouse that needs to be clicked will be highlighted. This will be tied down to a 3-D modelling software as well as a database that will link user input to a 3-D model. Depending on the time constraint, we can also simulate a mouse and a hand and will simulate the users' movements (similar to how the oculus simulates the hands moving)

For concept 4 of subsystem 1, in order to get the greatest results from the application, the user is first requested to calibrate the mouse in the settings before the lesson even begins. Second, exercises and lessons will be presented in video format; however, videos will not be required and won't last more than 4 minutes to prevent user distraction.

For concept 5 of subsystem 1, the tutorials will have automatic video players. Whenever the user clicks “play” on the tutorial button, the video data will be retrieved from the cloud storage and automatically played for the user.

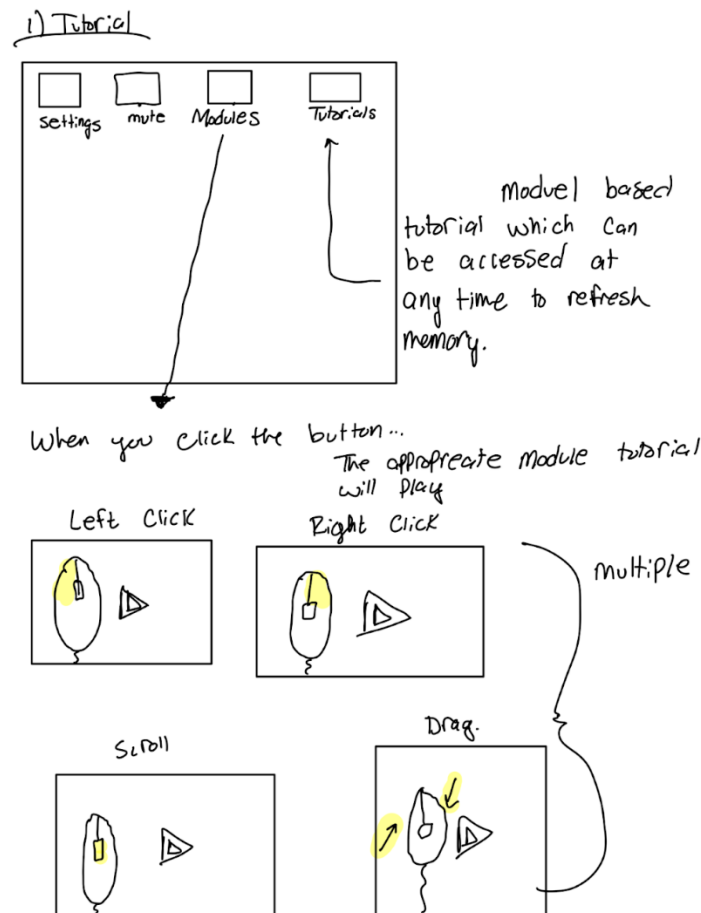


Figure 1: Concept 5 of Subsystem 1

For concept 6 of subsystem 1, the tutorial subsystem will be a combination of tutorial videos and instruction. Indeed, the sketch below represents an overall look at what this subsystem should be. A short video will be presented in the beginning of every exercise while also having subtitles as instruction on the bottom. Additionally, if the user wants to skip the tutorial video, they will have a button on the bottom right that they can press. To keep all the videos stored, there would be a database that will store the tutorial. Finally, there would be 3 lines on the top left of the screen that can be pressed to change the video.

The reasoning behind this idea of the subsystem is to simplify the tasks of the user. As a matter of fact, having options to watch a tutorial explaining the basic concept would help the user adapt to manipulating a mouse. With that, it will facilitate and organize the learning process which will keep the user focused and understand the task at hand.

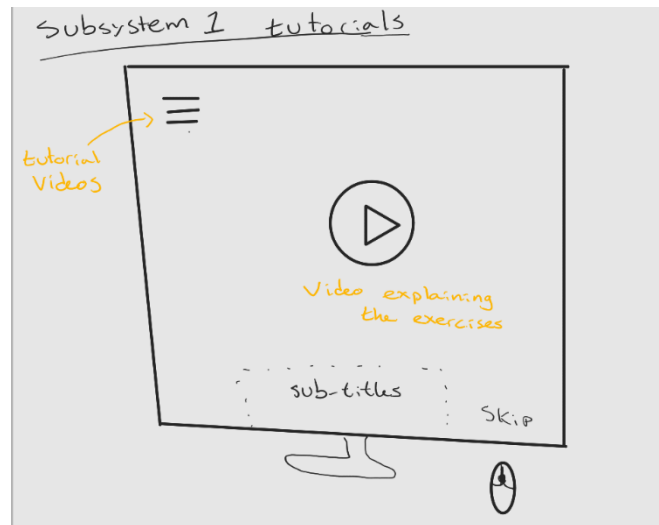


Figure 2: Concept 2 of Subsystem 1

## 9.2. Subsystem 2: User Interface

For concept 1 of subsystem 2, the UI should be split up into the navigation and the home screen on the front page. It should also be simple but not boring, and the text should be clearly visible. The colours should stick to a theme unless it is colours for specific reasons like the colour of a logout button can be red and not match the theme.

For concept 2 of subsystem 3, the UI will incorporate large text and contrasting colours in order to enable the user to be most comfortable. Upon opening the application, the user will be met with a tutorial that can be reopened through a “lightbulb” hint looking icon found on the screen. When opening the app, the user will be asked if they want to go into the “practice mode” or “the settings tab.” If they enter the settings tab, they will be met with various sliders in order to change text size, colours used, audio volume, etc. If they enter the “Practice” mode, they will be met with a symmetrical selection screen that shows all the different types of levels offered in the app eg. “Left Click Mouse Skills,” “Right Click Mouse Skills,” “Middle Click Mouse Skills,” “Shuffle,” “Real World Application,” “Short Cuts.” Throughout the application there will always be a power button icon that when clicked allows the user to close the application, there will also be a gear icon that opens up the settings tab and allows the user to change all the same things as before, as well, there will be a lightbulb icon that when left clicked will prompt the user with a hint.

For concept 3 of subsystem 2, the user interface allows the user to customize the application's colour, fonts, size, and internal text. An option is also provided by the programme for colour-blind users. There are three sections when the application first launches: settings, tutorials, and how to start using the application on the Windows home page.

Concept 4 of subsystem 2 will simplify the website/application for our user, and to make them not feel overwhelmed, we should minimize the amount of text on the screen at one time. This would include in more in-depth setting features menu (think of iPhone settings: Setting->general->about->system updates) so they can change the website to their needs, or just play as usual. This will, however, include having many coded hatboxes of the settings menu, which will retrieve the appropriate data for the next settings menu. If the user changes some settings, for example, the size of the text, this input will be stored in their accounts memory.

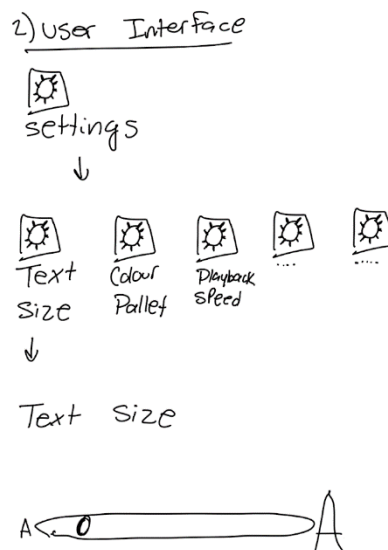


Figure 3: Concept 4 of Subsystem 2

For the concept 5 of subsystem 2, the 5th user interface subsystem idea simplifies the understanding of a task to the user. Indeed, as shown in the sketch below, the user interface will consist of an instruction bar, a hint icon and a guiding arrow. We believe that this idea respects the requirement of having a simple user friend because it does not undermine the quality of the user by treating them as a child. Instead, it demonstrates a step-by-step approach to accomplish the tasks. The background colour would be either white or pale yellow. The user would be able to change those settings by pressing on the setting icon. The reason why we incorporated 2 different colours in the setting would be to accommodate those who prefer having a more

comfortable screen to look at such as having a night mode. Additionally, this user interface provides a voice control option to read the instructions out loud. Finally, there is a hint icon to help guide the users to complete their task such as press on a figure or drag the figure that is changing colour from red to green.

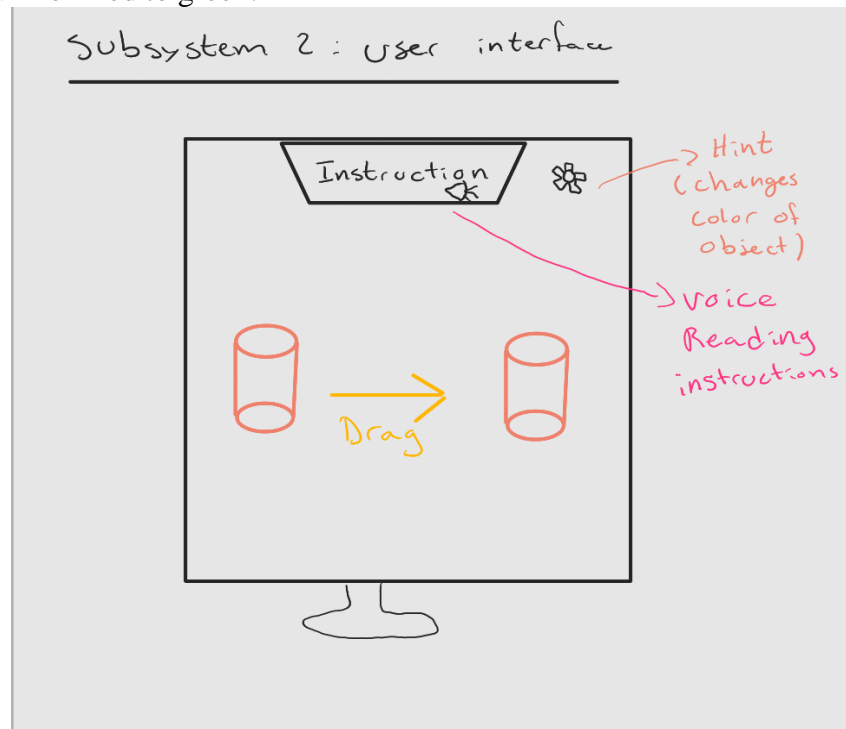


Figure 4: Concept 5 of Subsystem 2

For the concept 6 of subsystem 2, the UI will be split into two main menus: Lesson plans and minigames. Colours and design will be minimal and will give the user the option to increase the contrast, or even to magnify the screen to increase visual accessibility.

### 9.3. Subsystem 3: Exercises

For the concept 1 of subsystem 3, the way the exercises should work is the user is able to go directly into learning how to use a mouse, so starting from the basics and everything, as well as being able to go into a view of all the exercises and selecting the one they wish to complete. They should always first go into a basic exercise, explaining how to use the mouse and navigate through the app, where they have an option to skip. The exercise data will be stored in a database and retrieved when needed.

For the concept 2 of subsystem 3, there will be basic exercises that the user can choose from upon opening the app, “Left Click Mouse Skills,” “Right Click Mouse Skills,” “Middle Click Mouse Skills” and “Building Muscle Memory.” There will also be a “Real World Application”

tab where the user can see how these mouse skills will be incorporated into their daily tasks like email, Facebook, YouTube and digital design work.

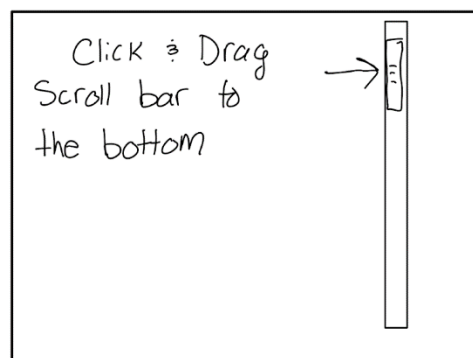
For concept 3 of subsystem 3, each lesson plan will tackle a main mouse operation. It will begin with a tutorial that will provide a visual representation of said mouse operation. It will then move to exercises that are similar to everyday tasks and each exercise will be stored in a database that will sync in real time in order to save the user's progress.

For concept 4 of subsystem 3, the first exercise will resemble a game, but subsequent ones will show you how to utilize this programme in all other programmes on the user's computer, like outlook, etc.

For concept 5 of subsystem 3, the exercises will follow frequently used platforms of our users, which according to the client during the initial client meeting, are Netflix/Disney Plus/other streaming services, and email websites. The features of these websites would be very similar to the exercises in our app. These can likely be coded using open-source code from the platforms themselves, or made new.

### 3) Exercise

→ Similar to real-life applications they would be using.



other ideas -

- Clicking to open/scroll Netflix
- Drag & Drop files

Figure 5: Concept 5 of Subsystem 3



For concept 6 of subsystem 3, the idea for the exercise subsystem will be 4 different exercises. As a matter of fact, to enhance the capabilities of the user to practise the basic mouse control skills, there will be an exercise that will consist of the user practising their precision of dragging a mouse and clicking on the left button. They will need to press on a number that appears on their screen. When successfully completed this task, the number will appear somewhere else on the screen. Every time the number is pressed on, the application will randomly place the number somewhere else on the screen. The second game of the application consists of pressing on an object and using the right button in order to utilize the copy and paste function. As the client mentioned during the meeting, they would want to utilize the feature such as copy and paste. Thus, having an application that teaches the copy and paste object would benefit the users in learning the basic mouse skills. The third exercise consists of a mouse image being utilized. The goal of this exercise is to utilize all the mouse functions. Hence, the users can learn by following the manoeuvres of the mouse. Finally, the fourth exercise consists of an email simulation. The application will be constructed around an email environment by giving a set of tasks such as a copy and paste a folder in an email, press send and scroll through email. In other words, the main purpose of this exercise is to englobe all the mouse basic skills in one exercise. It is mostly a realistic usage of exercise since the client specified that the user's main goal is to learn how to use a mouse in order to view their emails.

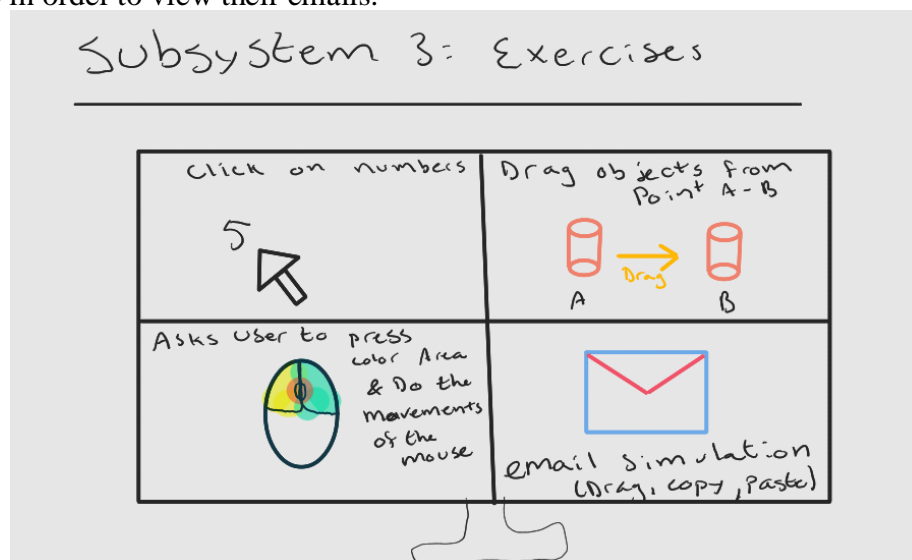


Figure 6: Concept 6 of Subsystem 3

## 9.4. Subsystem 4: Progress Tracking

For Concept 1 of subsystem 4, the progress will be tracked using a database, the user can enter their login data and then where they left off and which exercises, they completed will be there. A simple way would be to store the data only locally, and the data will be flushed once the browser is refreshed.

For concept 2 of subsystem 4, users can choose to be unranked and have no scores published, they can also choose to be ranked amongst the other users just in their building or users can choose to be ranked against others around the world.

For concept 3 of subsystem 4, the user interface will monitor the user's progress and, if the user is having trouble using the programme successfully, it will suggest that they take the lesson again so they can learn how to use it.

For concept 4 of subsystem 4, progress tracking can make use of a web-based cloud to store data for long-term storage. When a user logs in with their login and password, the most recent progress will be obtained and displayed to the user, and they can continue their progress at any time.

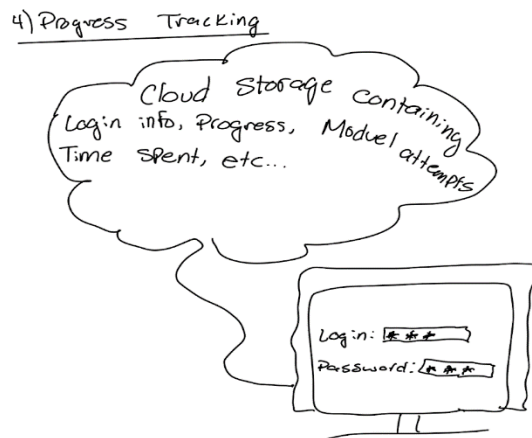


Figure 7: Concept 4 of Subsystem 4

For concept 5 of subsystem 4, a website will be hosted on a local network and will have a database that stores each user's login information as well as the lessons they have completed. Users can also opt to have their progress saved and if they decide to redo the exercises there will be a built-in timer function that will display how long it took them to complete the exercise.

For Concept 6 of subsystem 4, the idea of the progress tracking subsystems, the application will store the time spent, the number of tries and the total tasks completed. In other words, the application will reserve a section in the database to keep track of the user's performance during an exercise. For example, if a user's task would be to press on an object and the user fails to accomplish this task on multiple tries, the application will keep track of that information. Then, at the end of the exercise, the software will post a note showing the results to the user and asking them if they want to continue to the next exercise or restart. However, depending on a certain number of mistakes that occur during an exercise, the software will recommend the user to retry in order to master that specific skill that they are struggling with. Below is an image of the subsystem idea.

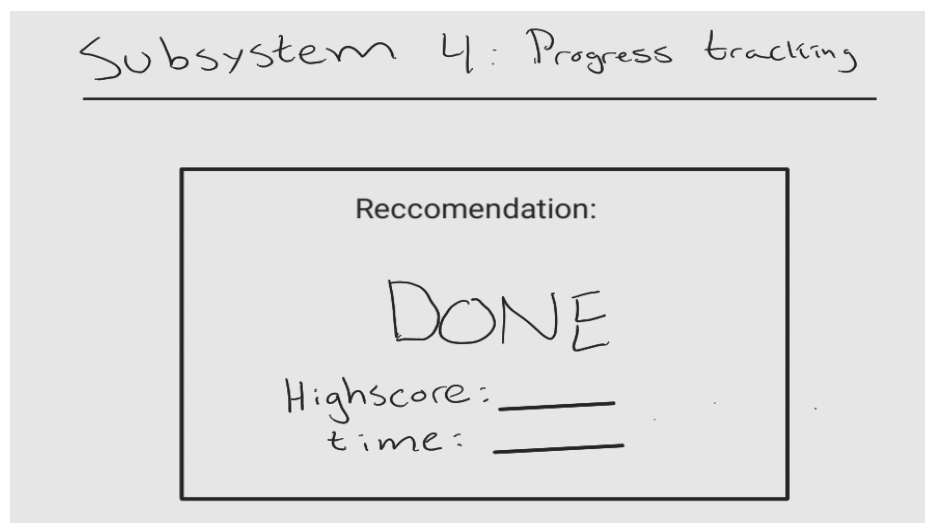


Figure 8: Concept 6 of Subsystem 4

## 9.5. Subsystem 5: Adaptive difficulty

For concept 1 for subsystem 5, once the user progresses through the exercises, the difficulty of some exercises can increase. Users can go back in difficulty, and since their progress is saved, they can choose different difficulties once they have it unlocked.

For concept 2 of subsystem 5, upon opening the app, the user will have various options to choose from depending on which mouse skill they want to learn as well as a “course” that incorporates all mouse skills (eg. Learning Left Click, Learning Right Click, Learning Middle Click, Putting it together). The user's progress will be tracked through a levelling system where the user will earn 1 star, 2 stars or no stars based on the timeliness of task completion. For example, 1 star if they complete the task, 2 stars if they complete it in a reasonable amount of time and 0 stars if they choose to skip the task entirely. Levels build off of each other therefore increasing in difficulty as you progress (imagine a “cut the rope” type of UI where you see what the easy, medium and hard levels in each section are).

For concept 3 of subsystem 5, depending on how doable it is, there would be a minigame submenu and it would just be imports of the legacy window prebuilt games which already have their difficulties built in.

For concept 4 of subsystem 5, the user has the option to choose the degree of complexity of the tutorials; the easier and moderate parts are probably going to include examples from games, while the more difficult levels address daily usage of the application.

For concept 5 of subsystem 5, the user has the ability to change the difficulty and work at their own pace. At the end of each level, a pop-up congratulatory message will appear, with the question, “Are you ready for a harder level?” If the users decide the harder level, the code from the database will be retrieved, and will display similar activities.

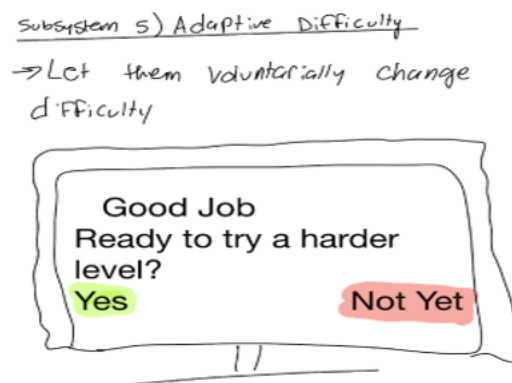


Figure 9: Concept 5 of Subsystem 5

For concept 6 of subsystem 5, the system will be developed with a method to increase the difficulty of the exercises by utilizing the information stored in the database from the progress tracking subsystems. Indeed, when the software collects the data of the user, it will send a notification mentioning if the user wants to increase the difficulty of the exercise. However, if the user refuses, the software will keep the score stored in the local database and re-ask the user when they revisited that specific exercise. An example of increased difficulty would be to press on a moving object or to minimize hints and step by step help to the user while they are practising. A sketch below represents some ideas to adapt the difficulty to the user.

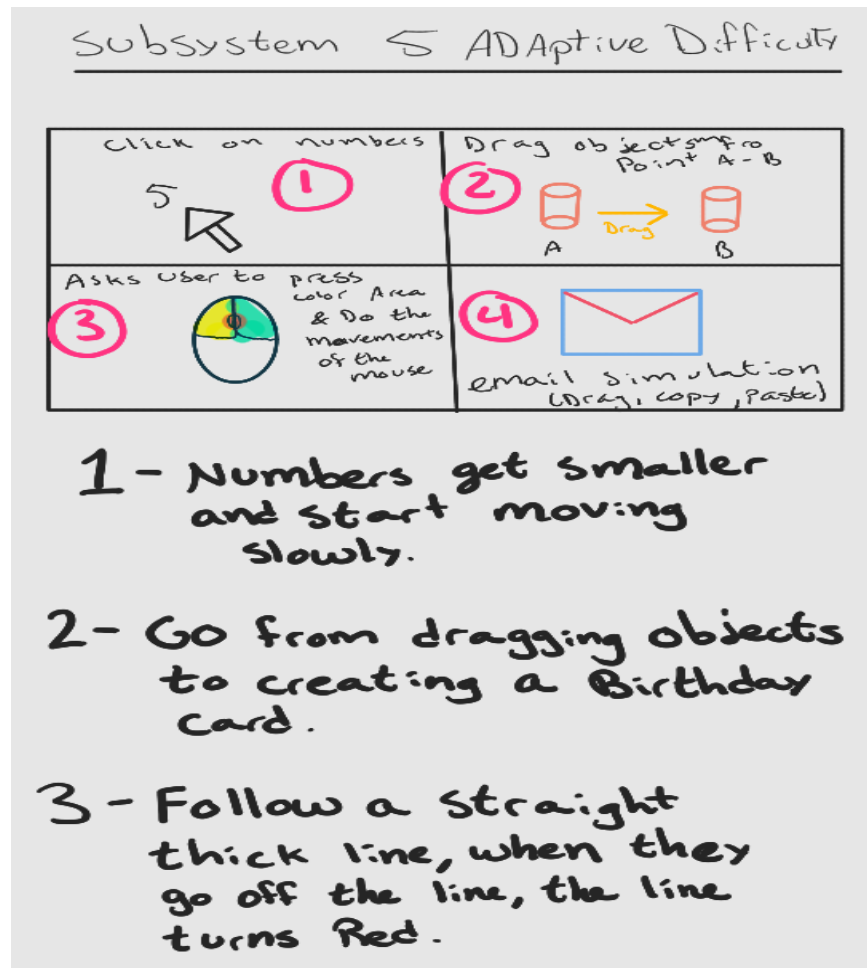


Figure 10: Concept 6 of Subsystem 5

## 10. Concepts

### 10.1. Concept 1

As for our first concept, we have opted to combine many subsystem ideas together in order to make a completed concept. We first decide on our subsystem 1 for the design concept. By analyzing our ideas with respect to our problem statement, our client's needs and the requirements, we deduced that a good subsystem 1 concept might be concept 3. Indeed, concept 3 communicates an easy understanding of the mouse controls to the user. As a matter of fact, our client repeated multiple times that they need an application software that would be very easy to understand and follow. Hence, the need for ease of use is one of priority 5 on our client needs statement table. And, while we believe most of our subsystems 1 concept ideas respect that need, we decided to move forward with this concept due to its uniqueness of having a 3D model of a mouse demonstrating the required manoeuvres in a step-by-step manner before the user begins their exercise instead of having a video of someone presenting the functions of a mouse.

For the user interface subsystem, we decided to choose the 4th concept. Ideally, the objective of this subsystem is to accommodate for the Requirements of being directed towards an adult audience, easy to use, and simplicity of basic interactions between the user and the software to allow an easy learning process. Indeed, this subsystem includes instructions, hints and voice audio to read the instructions out loud. Additionally, this user interface will be dedicated to satisfy the users comfort such as having non-aggressive contrasts that can lead to discomfort. For example, the client specified that users prefer having low contrast with a mix of yellow, black and white colours. Overall, the main purpose for this concept is to satisfy comfort and simplicity as the user needs.

For the exercise subsystem, the team has decided to choose the 5th concept design. The reasoning for choosing this subsystem is that the client mentioned multiple times that the users frequently use the computer in order to look through their emails, watch Netflix and look at social media platforms. Hence, we opted to go with a more familiar approach with the exercises. Indeed, by exercising in an environment composed of an email simulation or as a social media platform will help the users learn the basic mouse controls faster. Also, these exercises will help the users have a good idea on the required controls of a mouse needed to use their daily consumer platforms.

For the progress tracking subsystems, we have chosen concept 5. We believe that concept 5 will properly answer the need of having an autosave function. As a matter of fact, while the users would practise their basic skills, a progress tracking encrypted code will save the information into a database. Then, if the user wants to change the exercise and come back to it later, they will have their data record saved. Hence, we believe that this subsystem will allow an iterative choice from the user and more freedom since they will not be stuck on one specific task until it is completed. As a result, this does not diminish their ability to move on to more challenging tasks since they will have the ability to skill easy exercises.

As of the final subsystem which is the adaptive difficulty subsystem. We chose concept 1 as the main adaptive difficulty design. Indeed, since we are trying to allow all the users to feel as comfortable as possible, we wanted to give the freedom to the user to increase or decrease difficulty depending on their preference. By choosing this concept idea, we will be answering the need of not diminishing the ability of the user. As such, having the freedom to choose their difficulty will make them feel more comfortable to use the application. They will not feel as if they are less than a normal person with abilities. Hence, not being stuck on completing easy tasks will provide the liberty of deciding their difficulty.

Overall, the main thought process behind choosing these subsystems to create this concept was to make everything as comfortable as possible for the user experience. While there might be some inconsistency with all the needs and the capabilities of this software to answer those needs, we believe that this concept has a good basis to learning the basic mouse skills without it being difficult or non-empathetic towards the user.

## 10.2. Concept 2

For our second concept, our team decided to combine the subsystems stated above. To start, the application will teach the users the basic site navigation by an automatic video tutorial, accompanied with subtitles, which will play among opening the app, and when the user progresses to different activities. The videos will be stored and retrieved as needed within the application's database. A "skip tutorial" feature will also be included for users who wish to bypass the tutorial, and the videos will be available within the app for future reference. The user will be able to access all of the tutorial videos by clicking a tab button on the screen. This option was selected as our client stated many times that a video tutorial would be best suited for the users, as visuals will retain the users' attention for longer, and optimizes the user's understanding of the mouse skills. The subtitles are also important for any user who may be hearing impaired, or who learns better by reading information.

Our second subsystem, user interface, largely focuses on accessibility. As our client stated in our initial client meeting, each user is going to have different needs for our application. Because of this, we have decided to make our app fully customizable in terms of display. The user is able to change things such as text size (to accommodate users with vision impairment), colour palette (to accommodate users who need contrasting colours), and video playback speed (to accommodate those who need explanations played slower), among others. To simplify the website/application for our user, and to make them not feel overwhelmed, we will minimize the amount of text and options on the screen at one time. This would include a more in-depth setting features menu (similar to the Apple settings menu). The user will be able to change the website to their needs, or just play as usual. This will, however, include having many coded hatboxes of the settings menu, which will retrieve the appropriate data for the next settings menu. If the user changes some settings, for example, the size of the text, this input will be stored in their accounts of local memory. Aside from the accommodations, our user interface will also focus on allowing the user to choose which skill they focus on. Upon opening the app, the user can select modules such as "Left Click Mouse Skills," "Right Click Mouse Skills," "Middle Click Mouse Skills," "Shuffle," "Real World Application," "Short Cuts."

As for specific exercises within our application, we will follow a module based system, such as “Left Click Mouse Skills,” “Right Click Mouse Skills,” “Middle Click Mouse Skills,” “Shuffle,” “Real World Application,” “Short Cuts.” This will allow the user to master all of the functions of a generic mouse. Some examples of tasks within these modules consist of actions found in games, functions used in the real world. For example, the left and right click module could include a drag & drop tasks, similar to the motions used when uploading a file. Real world applications could include a simple simulation of popular applications used by the user. Stated by our client, these include: Netflix, Disney Plus, Outlook, Gmail, and Facebook. These simulations will include all of the functions within the actual app, without the consequences of accidentally misclicking something by mistake.

The progress tracking feature will use a web-based cloud for data storage. Some of the data being recorded will include the amount of time taken to complete each task, how many errors, and a number of attempts until completion. Based on the user's performance, an automatic pop-up will suggest the user to retry, or continue within the modules. This will ensure that the user has the option to retry the skills they feel needed improvement, or continue if they wish. The progress of the user will be uploaded to a cloud-based data storage, associated with their login and password which will retrieve their accounts progress data whenever they log into their account. An auto-save feature will be used to upload data to the cloud storage upon completing a level.

An adaptive difficulty feature will be used to progress the user to more challenging levels. To avoid a false sense of achievement, a star system (similar to the systems found in games such as Candy Crush Saga and Cut the Rope) will be displayed after each level to show the user their performance. Performance will be based upon factors such as time spent, and errors made. To give the user maximum control of their learning experience, they will have the option to move to a harder level, even if they did not achieve three stars on the previous level. A message such as “Are you ready for a harder level?” will display if they passed a level (for example, achieved  $\frac{1}{3}$  stars). If the user decides the harder level, the code from the database will be retrieved, and will display similar activities which require more skill. For example, a drag and drop game with smaller hatboxes.

### 10.3. Concept 3

For our third concept, we are combining the different subsystems above. Firstly, the product will prompt the user to calibrate their mouse for the best mouse sensitivity before the tutorial begins. A menu will pop prompting the user to enter their desired sensitivity, followed by a test sensitivity option in order to experience the selected sensitivity. After they have calibrated their mouse, an initial video tutorial will pop up, showing the user how to navigate through the application. The initial tutorial will be stored in the local files of the application and can be skipped at any time by pressing the skip button. There will also be optional video tutorials before every module, which guides the user through what they will need to do in the exercise, which can also be skipped whenever, by pressing the skip button. This video tutorial will also be stored



in the local files of the application. All tutorials will be as short and precise as possible, as to allow users to stay focused on the task at hand.

In the second subsystem, the user interface will focus mainly on accessibility, so the UI will be as simple as possible, without being too boring or childish. The entire application will follow a colour palette consisting of no more than 4 different colours, excluding special situations such as the logout button, which can be in a red colour. The font will be clearly visible, in the font 24px or above. The UI will have a navigation bar at the top of the screen at all times, and below the bar will be the main screens. The navigation will consist of different sections, such as the homepage, exercises, settings, tutorials, and an about section. It will also have a maximum height of 10% of the screen, so as to not block the view, and it will be hidden when doing an exercise or watching a tutorial. Another thing is the contrast between colours will not be too extreme, it should use colours that are supportive of people with colour blindness.

For the third subsystem, the exercises will have their section, where it displays a list of different mouse exercises that they are able to do. They can either choose an exercise from the list of exercises or go directly into a “playlist” of exercises, where the “playlist” contains exercises for each basic mouse function. There will also be an initial exercise to help them practise navigating through the app itself, so they can get familiar with the UI. However, this initial exercise is optional; users will have the option to skip by selecting the “skip” button. The different basic mouse exercises will be made by us or sourced from open-source tutorials, and stored locally within the app. There will also be exercises where the user is made to feel like they are doing a certain task within another application, such as sending an email, or browsing Netflix, and these tasks will also be either created by us or sourced from open-source tutorials, and stored locally within the app.

In the fourth subsystem, progress tracking will be done through a database. The users can register then log into their accounts to load back all their previous settings and where they were before they logged off. They can see all the exercises in which they have completed, as completed exercise will have a grey tint over the exercise saying completed. This way the user can be allowed to close the app and come back the next time to their exact spots. Additionally, user stats can also be tracked, such as the number of exercises done, mistakes made, time taken, and other stats. All data will be stored in a database. (The storage method might become local cache if there is not enough time to implement a database system.)

Lastly, for the fifth subsystem, the adaptive difficulty will be implemented by utilizing the statistics stored in the database. Once the system has deemed the user stats good enough, there will be an option to increase the difficulty of that task if the user wishes. The stats the system will look at include if they skipped the tutorial or not, the number of mistakes made, and the time it took to complete the exercise. If the user does not increase the difficulty for that specific exercise, the system will prompt the user again if they wish to increase the difficulty once they revisit the task, but there will also be an option for the user to stop the system from prompting the user to increase the difficulty, as it can become very annoying.

## 11. Analysis of Concepts

Concept 1 will have a user interface rated as 2 being simple to understand. The concept of the UI is to get to the lesson plans in under 4 clicks while also having a simple static background in order for the users to properly see the menus being displayed. Likewise, the transition time is low as it doesn't take less than a second to go from page to page as the page is minimalistic in nature. The number of tasks will vary depending on the exercises, although the current number of tasks will be above 10 as it will take into account the multiple different mouse operations as well as the applied examples such as getting started on the outlook or Facebook. The number of tasks will vary from 1 being easy to 5 being hard but doable. The user will decide which difficulty. The colours on the app will be within the 32-bit colour map in order to utilize the full range of colours. All three concepts will not cost anything to produce, the font size will have the option between standard 12, or 24 to allow for different eyesight. All three concepts will be within the age range of 24 as many users are on the senior side and will have a more mature themed content.

The user interface of concept 2 is rated as 2. Concept 2 has a user interface of 2 because it is more organized since everything is found in its section. This allows a better understanding and for the user to manoeuvre around different modules. Similar to the previous concept, the transition time will be within a second. However, the exercises in this concept will be split into a more standard format. Each exercise will be under a subcategory of a mouse operation. However, the applied examples such as shortcuts will be in their own section to distinguish individuals that are interested in learning more advanced mouse operations. Additionally, similar to concept 1, concept 2 has 5 unique tasks, an age recommendation of 18+, and a cost of \$0. We believe that this is a good estimation, since we simulated it on a piece of paper by analyzing how much mouse manoeuvre we need to do. What makes concept 2 good for the user is that it represents a vast majority of task difficulty. Difficulties from 1 to 5 for every exercise will be presented. Finally, it has around 3 to 6 different colour palettes. The number of colour palettes depends on the exercise or on the main menu. This was deliberately done to simplify the user's experience with the application. We believe having different non-high contrast colours will allow users to easily manoeuvre around the application.

Concept 3 focuses on maintaining a balance amongst the choice of colours. The contrast between the colours will be much softer and will be somewhat monotone in order to allow for the easiest visibility between the menus and the background. Likewise, the transition time will be about a second. However, the exercises in this concept are more liberating in that the user can select a specific exercise to practise on or will be able to randomize the exercise. Additionally, we have compared all three concepts and have determined that concept 3 had the most difficult user interface since it has modules within modules. This means that the user would need to do additional steps to reach the exercise they want to practise. As for the transition time, the number of tasks, the age recommendation, and the cost, they are all similar to concept 2. However, what really differentiates this concept is its level of difficulty for the tasks. As a matter of fact, this concept does not truly increase exercise. It changes the level. Hence, if someone wanted to practise the same exercise but on a higher difficulty, they would not be able to do it since they only have different levels as if it was a mobile application.

*Table VI: Concepts Analysis to Target Specifications*

	User interface design complexity (Rating 1-5)	Transition time (s)	Number of unique tasks (# quantity)	Difficulty of tasks (rating 1-5)	Number of modules (#)	Different colours in the palette (# colours)	Age Recommendation Age (#)	Font size (# font)	Cost (\$)
Concept 1	2	1s	5	2-5	6	2-3	18+	12 or 24	\$0
Concept 2	2	1s	5	1-5	5-7	3-6	18+	10-48	\$0
Concept 3	3	1s	4-5	3	5-7	4	18+	~24	\$0
Ideal target specifications	2	1s	4	2	5	4	>18 years	18	\$0
Marginal target specifications	<3 and >1	<2	<5	<3	<7	Between 3-6	>15 years	Between 14-20	\$0

By analyzing the above table, we can deduce that concept 2 has the better overall values for the ideal target specifications. Indeed, concept 2 falls into range for every ideal target specification except for the number of unique tasks where concept 2 has a value of 5 and the ideal target specification is a 4. Similar to concept 1. As for concept 3, the user interface difficulty is a 3 which does not respect our ideal target specification of 2. In order to rank these concepts, we did not only base our judgment on the target specification. As a matter of fact, we also used our problem statement and our design requirement to determine the best concept out of the 3 that we have developed. Hence, concept 2 would be the best, then concept 1 and finally concept 3. Even if we did not base our judgment only on the target specifications, we can clearly see that the target specification would have sufficed to represent this order of rankings. This being established, the team will still take into consideration the feedback from the client and will not completely discard the two other concepts since we have not yet done any prototypes to solidify our statements and the values we have.

## 12. Global Design concept

Our global concept will be based on concept 2. The UI will mainly focus on accessibility, so the complexity of it will be minimal without making it look like it is for a younger audience. The font for the UI will also be varied from 10 to 48px depending on the type of text, but the minimum font size might need to increase readability since the users might not always be really close to the screens. The colour palette will also comprise 3-6 colours to maintain unity, as well as have an option to change the colour palette to a different one, which will allow for a better experience with people with colour blindness. It will contain all the different tasks required to learn how to use a mouse, so left click, right click, middle click, dragging stuff, as well as having the exercises represent a real-world scenario such as sending an email or going through social media. There will also be about 5-7 modules, each one focusing on a different task or scenario. Our aim is for 5 modules, one module for each of the 5 tasks, but if we have enough time then we can create more modules. The difficulty of the tasks can change from a scale of 1-5, as every time the user completes a module, a score will show up and if the user achieved the required score, the user can increase the difficulty of the module if desired, so users can choose to stay around 2 or 3 if they wish to practise, or increase it more for a challenge. The cost of this software is free, and the target demographic is guided towards adults.

Additionally, this concept has many benefits such that it respects all constraints that we have established based on the user needs and the problem statement. As such the team will be able to focus on the next iteration in order to develop our prototype step by step. Hence, since this concept also respects the established functional and non-functional requirements, we will be able to envision how the detailed design will look like due to the high level of analysis that we have performed. For example, this concept respects the non-functional requirement of being age appropriate, easy to use and simple to understand. As for the drawbacks, concept 2 might seem complicated to produce since the team does not have a lot of knowledge to create an application. As such, to produce this application with the desired target specifications, the team plans to learn more about software development throughout the upcoming phase of this project.

## 13. Visual Representations

### 13.1. Concept 1

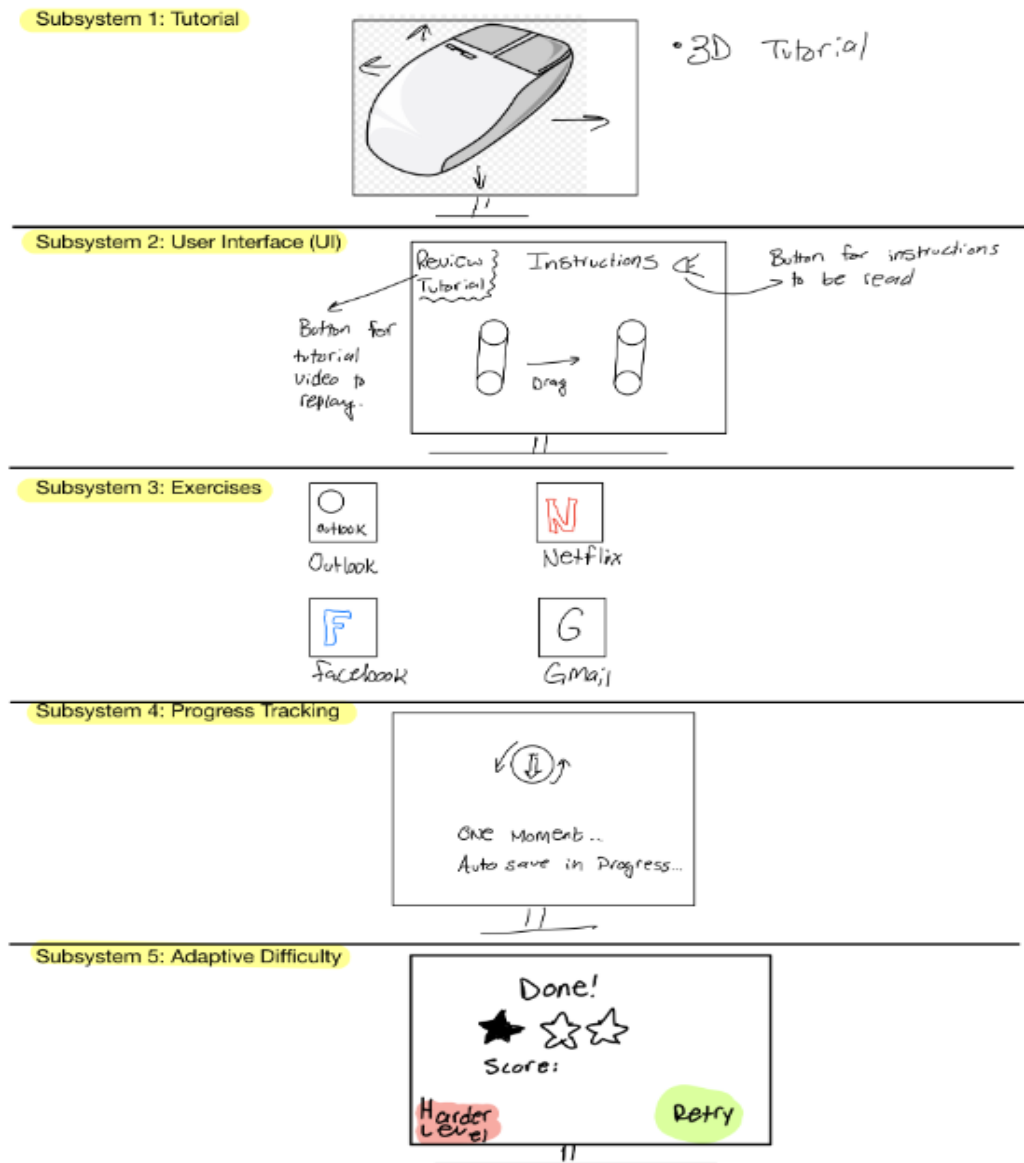


Figure 11: Overall Concept 1

## 13.2. Concept 2

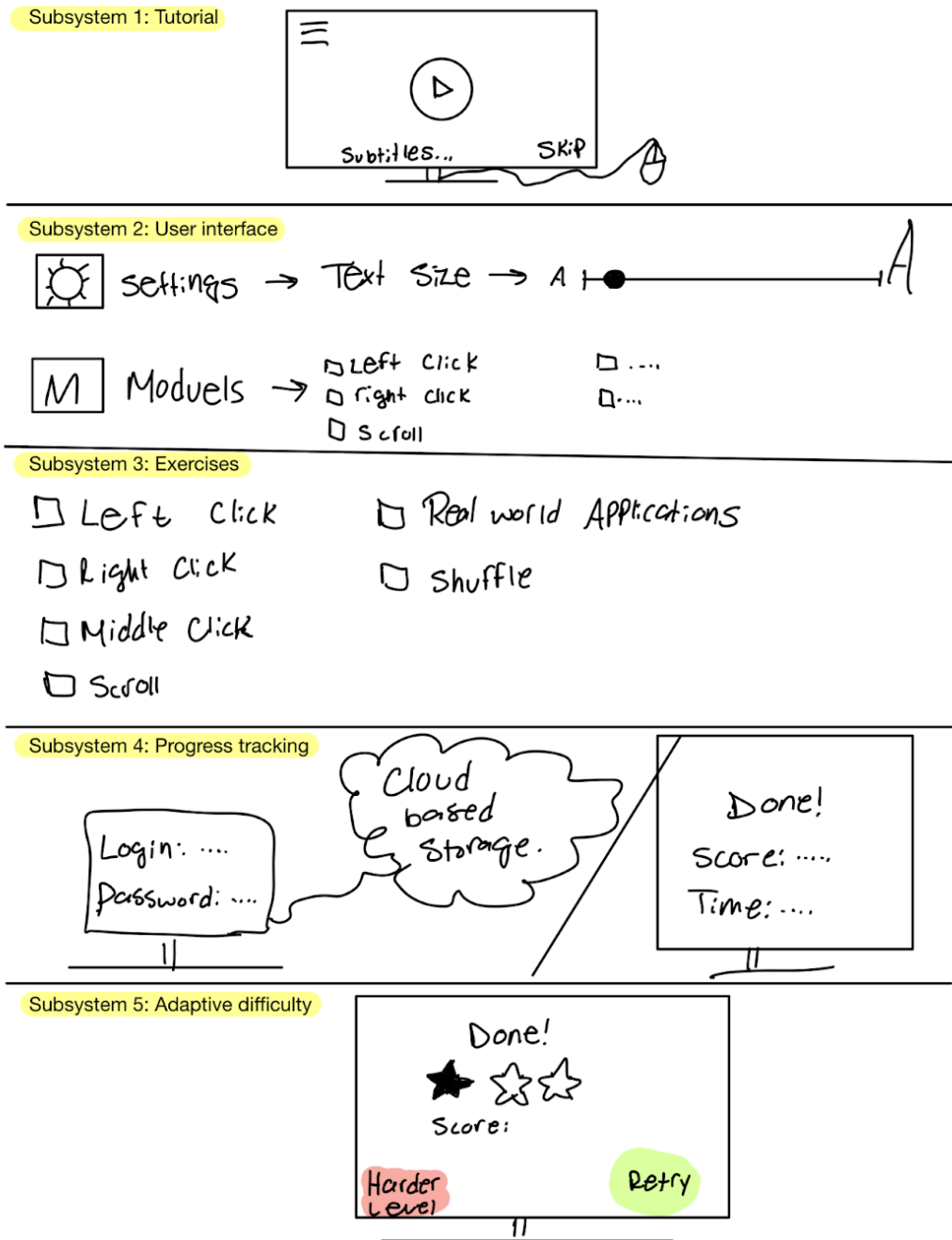


Figure 12: Overall Concept 2

### 13.3. Concept 3

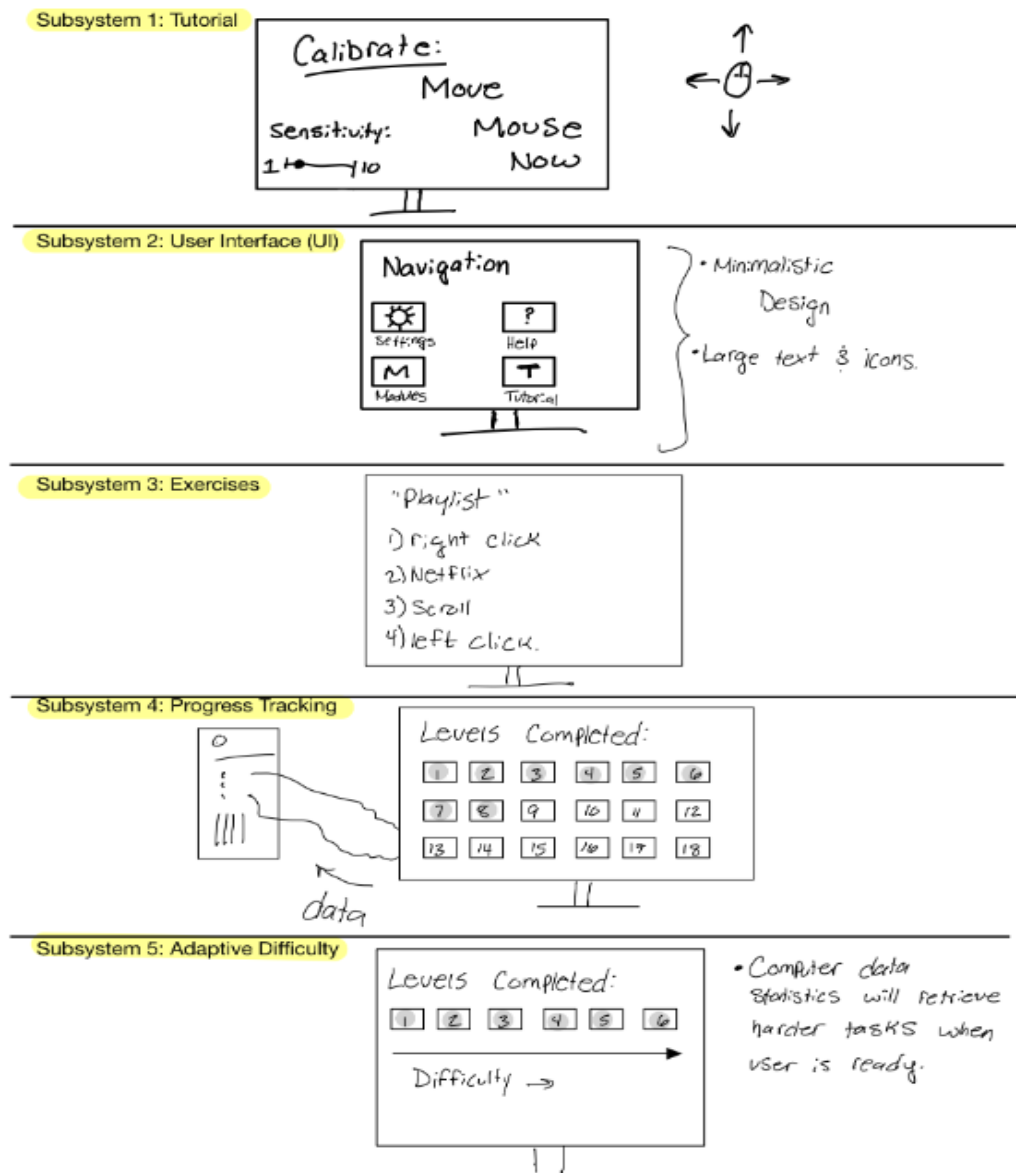


Figure 13: Overall Concept 3

## 14. Wrike Gantt Snapshot

<https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=8mBNcgPEOiO8QbDIhag4nPcx8DbQCyJG%7CIE2DSNZVHA2DELSTGIYA>

## 15. Conclusion

All of the information above, from our client needs to our final design concept, was derived from gathering information from the initial client meeting. Our team prioritized the needs, created a problem statement, defined metrics, developed target specifications, subsystems, and have created a globalized concept which will be used as reference going forward. The next steps in our design process will be to determine the feasibility of key elements of our product, such as coding language, and data storage method. When taking into consideration constraints such as time, money, and skill set, we will be able to confirm all aspects of our project and start creating high-fidelity prototypes. Hence, this information will be utilized to develop our upcoming detailed design and prototypes.



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