



Queen Mary

University of London

Science and Engineering

QMUL-BUPT Joint Programme  
JP Student Innovation Centre  
**Annual Showcase 2021/22**

# Design and implementation of virtual agents that can provide support during online learning and self-studying

Ziqi Zhou

Project Leader: Dr Marie-Luce Bourguet

# Motivation and Requirement

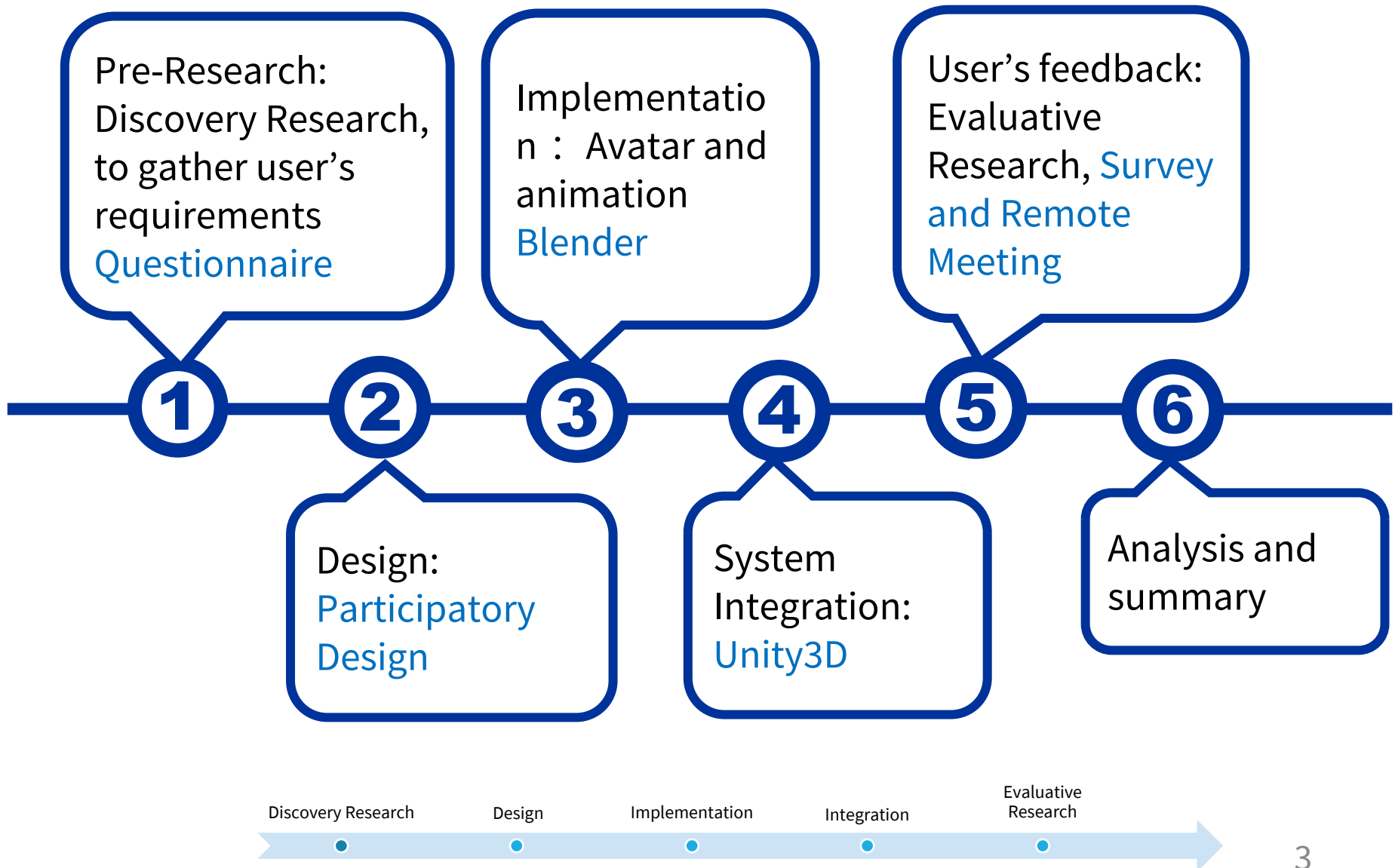


- **Online learning** and **self-study**
- **Advantage: Able** to satisfy daily study routine at home.
- **Disadvantage: Unable** to provide attractive learning environment such as teachers' support and active interpersonal atmosphere.



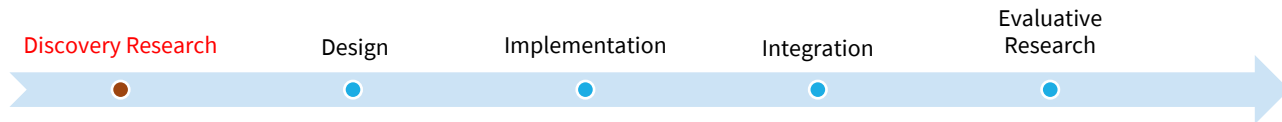
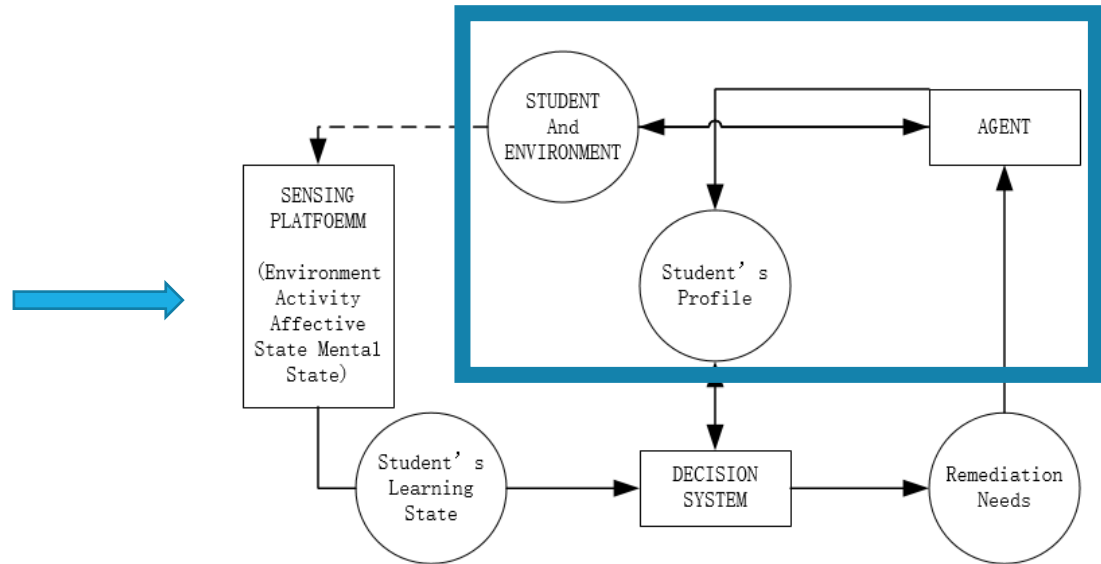
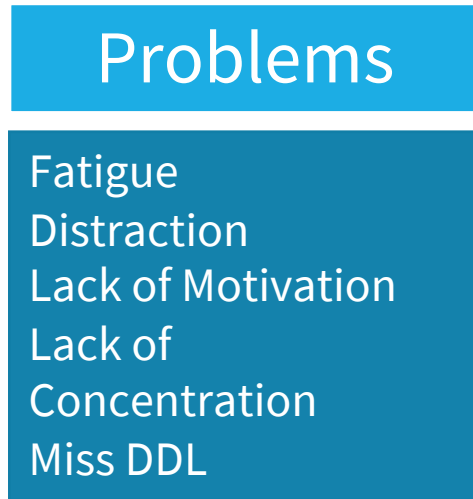
Maintain student's learning state of self studying and online-learning, and to help students develop their self-regulated learning skills.

# Project flow chart



# Solution

- Design and implement several virtual agents based on **Unity3d** through **participatory design (PD) approach**.



# Virtual Agents



Virtual Agent “Sam”

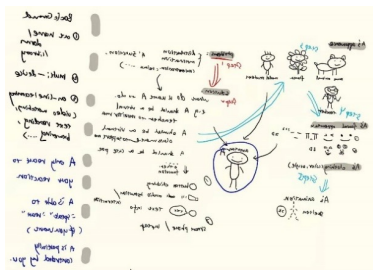
- **Definition** : Autonomous software agent that can interact with the environment and the user.
- **Significance**: A well-designed believable avatar can influence people's decision making in real life through the manner of human-computer interaction.
- **Design of virtual agents**:
  - ① Based on the “personality”
  - ② Verbal behaviours : dialogues or chatter bots
  - ③ Non-Verbal behaviours : Facial expressions, Gestures and Gaze

# Background Introduction

- **‘Participation’** within HCI practices can refer to consultation and user testing or to studies of self-organized groups where the researcher is the participant–observer.

1

Brain storm



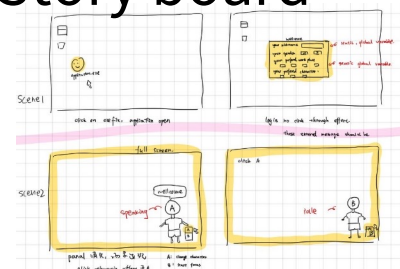
3

Context mapping



2

Story board



4

“tool to think with”

Epistemology

What are the kinds of knowledge constructed?  
To what degree can we trust the knowledge?  
What is the potential for transfer?  
How is knowledge shared?

Values

Which values drive the process, explicitly or implicitly?  
What are the conflicts and dilemmas arising from values?  
How do values change in the process?  
How are values reflected in decisions?

Outcomes

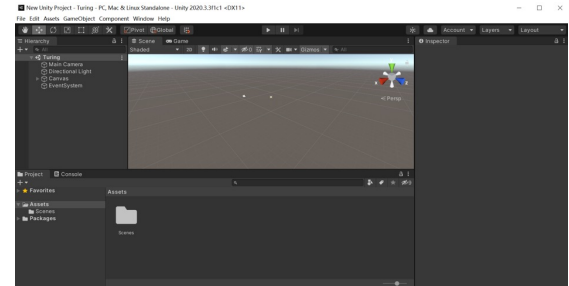
What are the different interpretations of outcomes?  
Who owns outcomes?  
How sustainable are outcomes?

Stakeholders

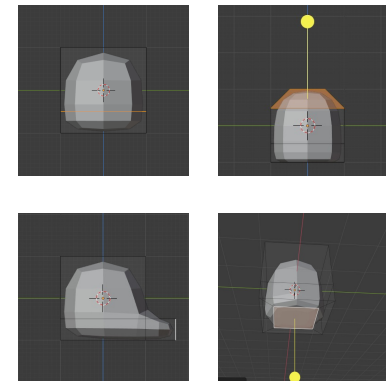
Who are the stakeholders and who participates?  
What is the nature of their participation?  
How do stakeholders and participants benefit?  
What happens when the project ends?

# 3D Game Engine and Modelling

- **Game Engines** supports the design of computer games or interactive real-time graphics applications.
- **3D Modelling** is to build models through virtual 3D space, using 3D modeling software.
- **Unity3D 2020.3.3 and blender**



Unity3D



Modeling with Blender

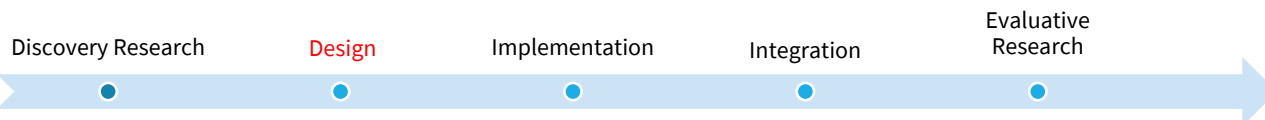
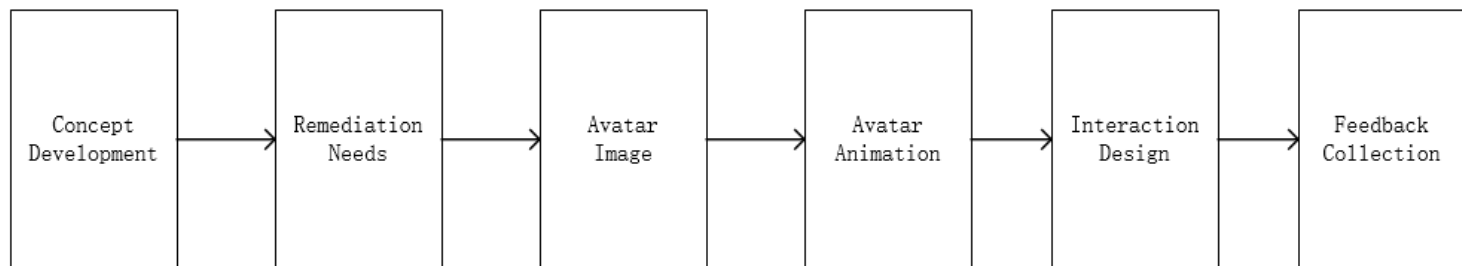
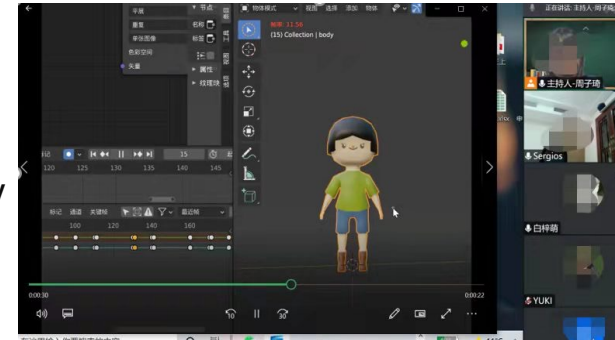
# Participatory Design Process

- **Design team:** 6 college students majored in a variety of subjects.

Including: Telecommunications, Psychology, Economics, Multimedia technology, and Software Engineering.

- **Meeting Schedule:** A total of eight participatory design events, between 10/30/2021 and 3/30/2022

- **Meeting Platform:** online meeting, TenCent Meeting.





# Participatory Design Result

## • Remediation Needs :

- Ask the user to take a break
- Ask the user to do another task
- Ask the user to exercise
- Ask the user to change their posture
- Ask the user to start working
- Ask the user to change their workplace
- Remind the user of distractions
- Remind the user to focus on
- Remind the user of their learning goals
- Remind the user to put down their phones
- Chat with the user
- Encourage the user, show empathy
- Be happy for the user

Idle

Discovery Research

Design

Implementation

Integration

Evaluative  
Research

## • Avatar Character:

### Supervisor, Companion and Friend.

- A **“supervisor”** assume the role of a “manager”, it has stricter verbal and non-verbal behaviour.
- A **“companion”** is a character that remains silent most of the time, it shows support and empathy while needed.
- A **“friend”** is more like a vivacious character between companion and supervisor.



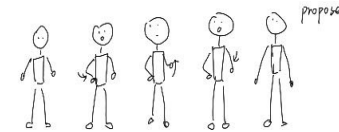
# Participatory Design Result

- Avatar behavior design:

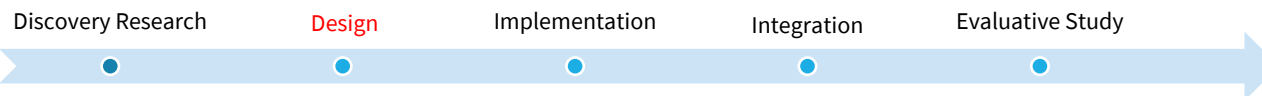
Table 1. Avatar behaviour

Avatar	Non-verbal behaviour Animation	Attitude	Facial expression	Verbal behaviour Avatar3 Verbal behaviour
1	Ask user to take a break 	Neutral		(User Name), Stretch your body!
2	Ask the user to do another task 	Neutral		(User Name), You should try something else
3	Ask user to exercise 	Exciting		(User Name), You should get some exercise
4	Ask the user to change their posture 	Neutral		(User Name), Poor posture can also lead to poor productivity. Try sitting up straight
5	Ask the user to start working 	Angry		(User Name), You've been hanging around here a long time. Get to work
6	Ask user to change their workplace 	Neutral		(User Name), Maybe you can be more productive working somewhere else. I recommend (User Preferred Work Place)!
7	Remind the user of distractions 	Neutral		(User Name), Something is distracting you.
8	Remind the user of the need for focus 	Angry		(User Name), Concentrate on your work
9	Remind the user of their learning goals 	Neutral		(User Name), Remember the goals you set for yourself!
10	Chat with the user 	Delight		(User Name), Nice day, isn't it
11	Encourage user, show Empathy 	Delight		(User Name), You've done a great job

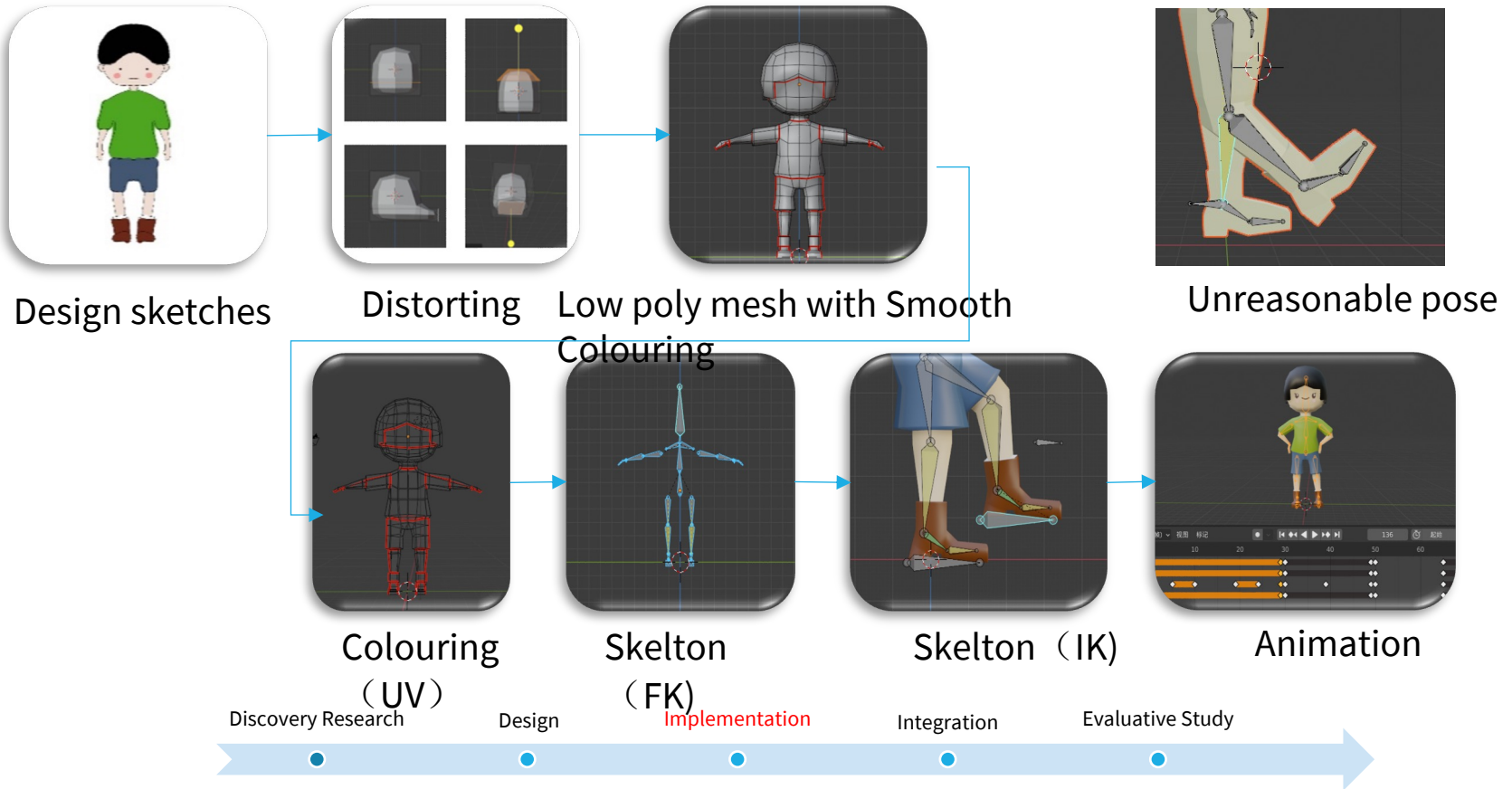
		Neutral		(User Name), Maybe you should try another task
3	Ask user to exercise 	Exciting		(User Name), Get some exercise!
4	Ask the user to change their posture 	Concern		(User Name), Poor posture is bad for you
5	Ask the user to start working 	Sad		(User Name), Please start working, I'm dying.
6	Ask user to change their workplace 	Concern		(User Name), Maybe you can be more productive working somewhere else. I recommend (User Preferred Work Place)!
7	Remind the user of distractions 	Concern		(User Name), Something is distracting you.
8	Remind the user of the need for focus 	Sad		(User Name), Concentrate on your work
9	Remind the user of their learning goals 	Neutral		(User Name), Remember the goals you set for yourself!
10	Chat with the user 	Delight		(User Name), Nice day, isn't it
11	Encourage user, show Empathy 	Delight		(User Name), You've done a great job



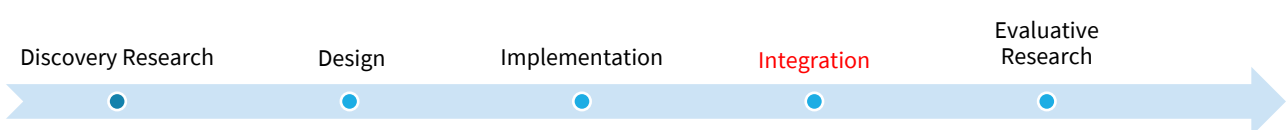
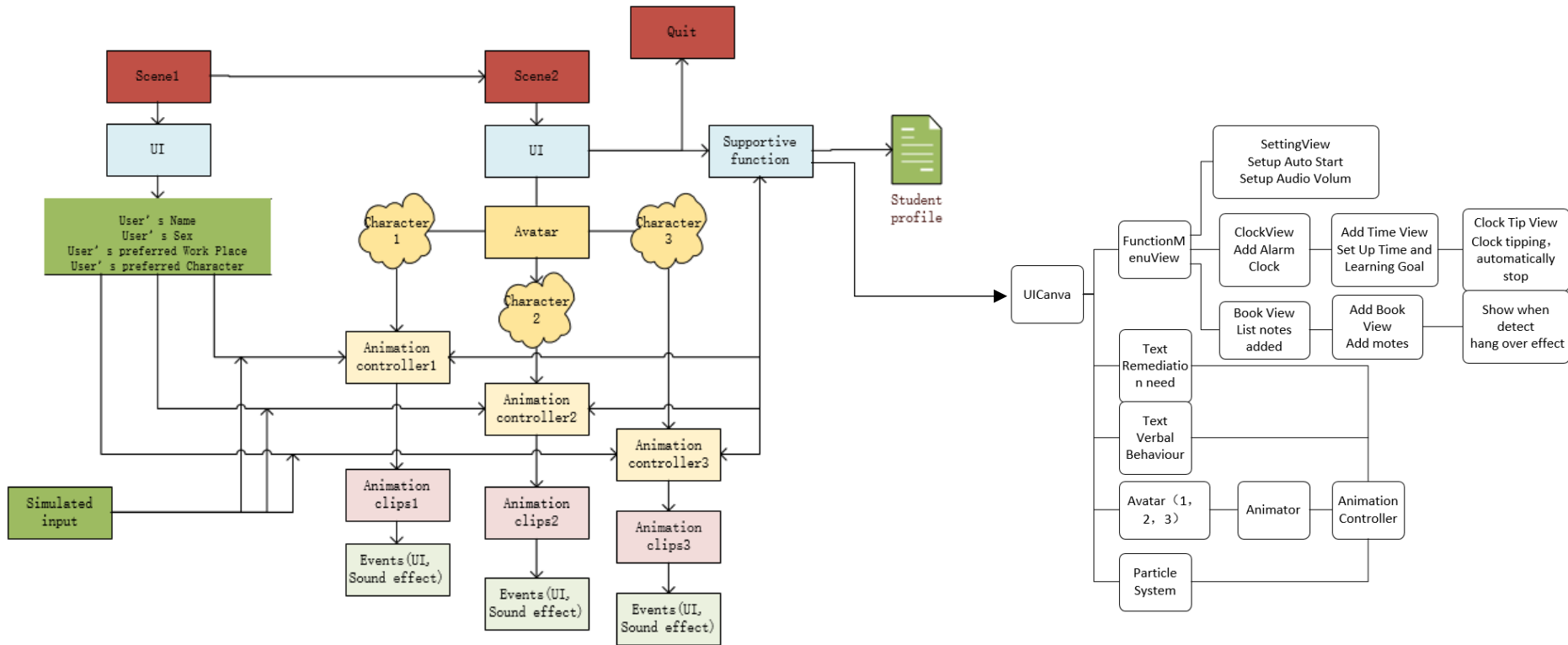
Forty-two different behaviors for the three characters.



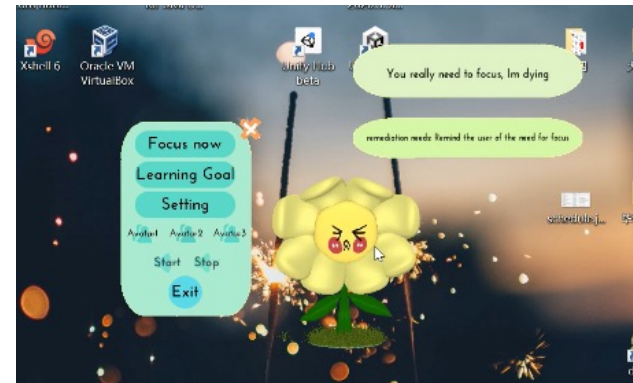
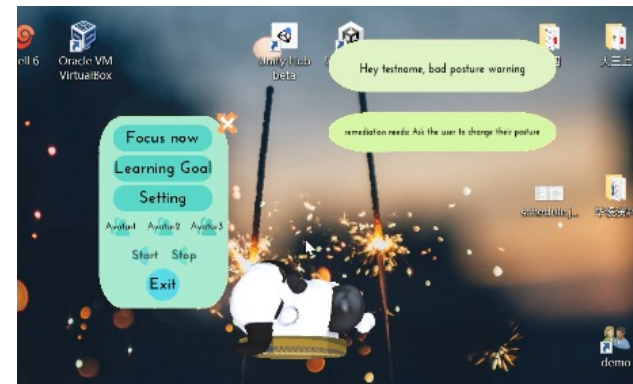
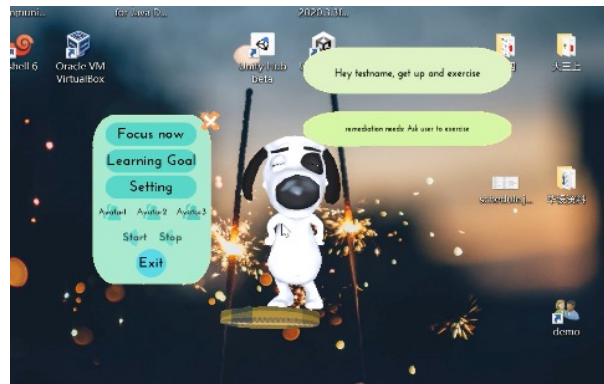
# Implementation of Avatars and their animation



# System Integration



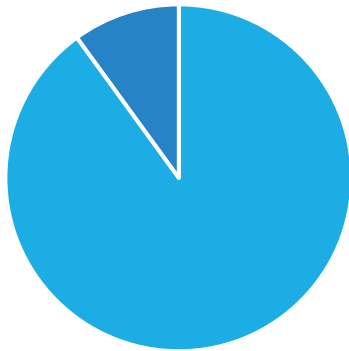
# Screenshots



# User Study

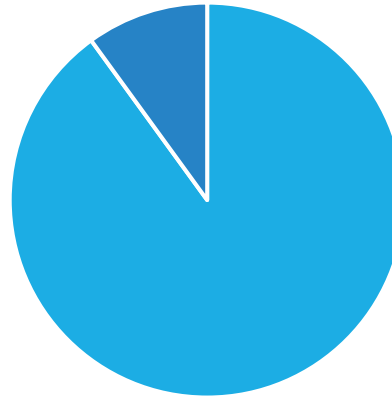
- Questionnaire  
Feedbacks from 21 students

Believability of Avatar



■ Satisfied ■ Could be better

Distraction  
Caused by Avatar

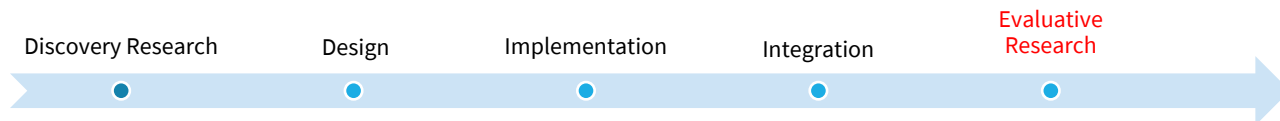


■ Satisfied ■ Could be Better

Features that help user  
understand the messages



■ Facial Expression ■ Gesture  
■ Verbal Behaviour ■ Character

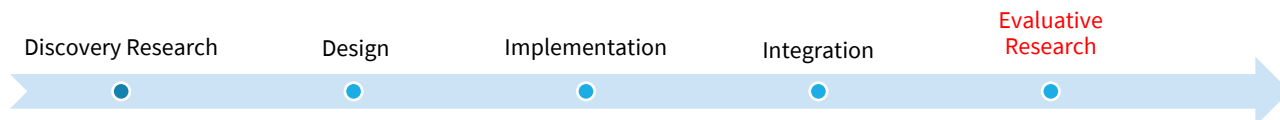


# User Study

- First-hand feedbacks, from 3 participants

## Distant Usability Testing

Tasks	User1	User2	User3
Start the software	1	1	1
Adjust the size of the avatar	1	1	1
Adjust the avatar's position on screen	1	1	1
Rotate the avatar	0	1	1
Arouse the function panel	1	1	1
Setting focus alarm clock	1	1	1
Record learning Goal	1	1	1
Change Avatar	1	1	1
Leave a note	1	1	1
Audio instruction	1	1	1
Understand avatar behaviour (Verbal and Non-verbal) correctly	10/10	9/10	10/10

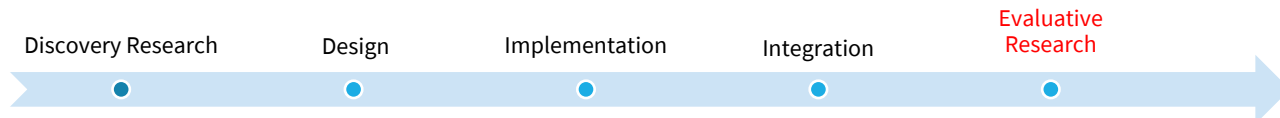


# User Study

- First-hand feedbacks, from 3 participants

## Self reported learning states

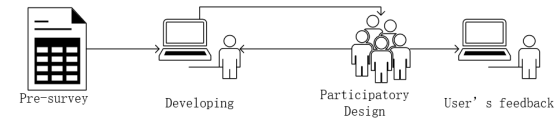
Learning State	User 1	User 2	User 3
Learning efficiency	Increased	Slightly increased	Almost Unchanged
Fatigue	Slightly decreased	Slightly decreased	Almost Unchanged
Learning Motivation	Increased	Increased	Increased
Distractions	Almost Unchanged	Almost Unchanged	Almost Unchanged
Concentration	Increased	Almost Unchanged	Increased



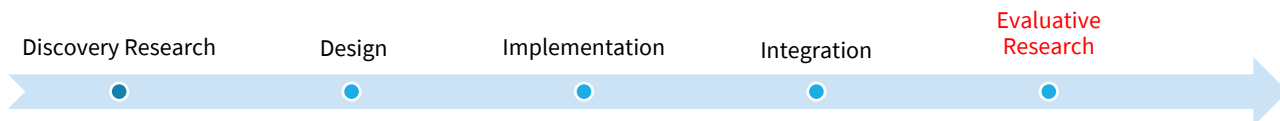
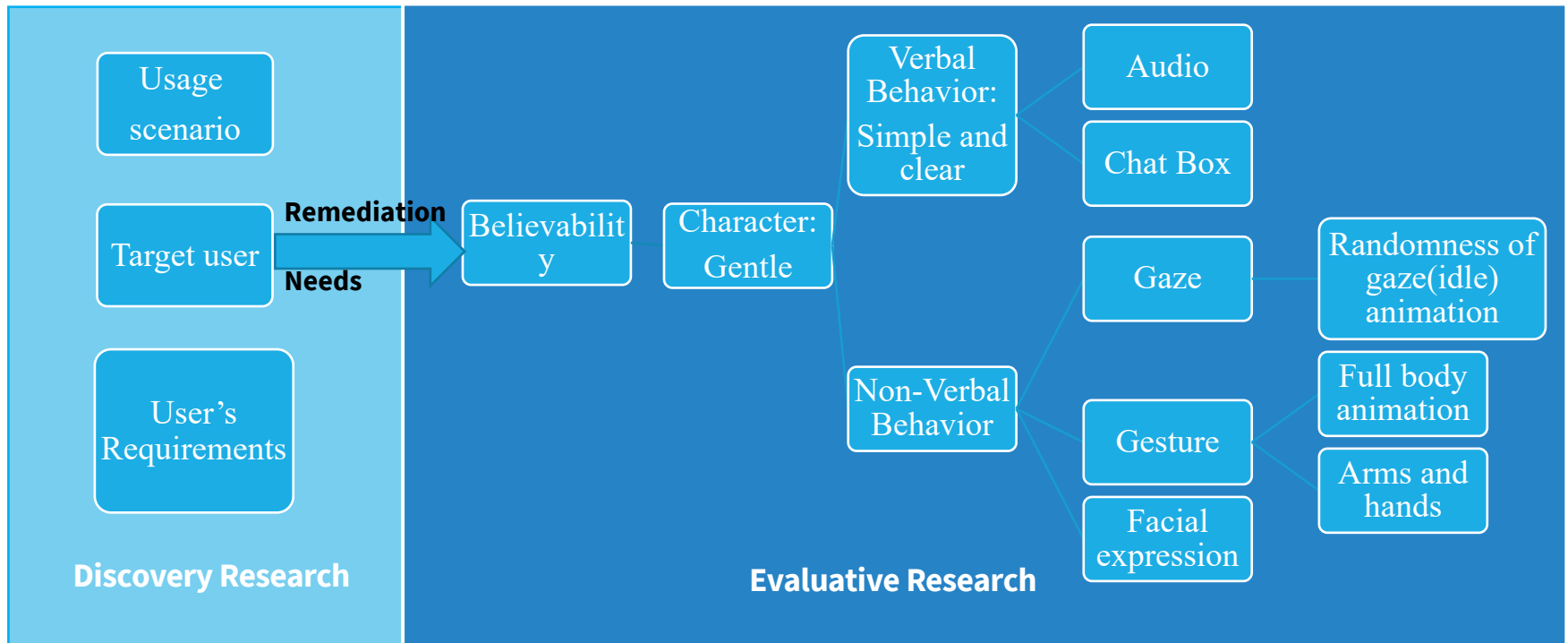


# Conclusion: Guidelines for the design of supportive agent

- **Design method:** participatory design shows strong practicability.



- **Aspects to be Considered:**



# Thank You

