Course Development of App Making for Novices: Focused on Science Educators

Seok-Hyun Ga[1,3], Changmi Park[1], Mingu Lee[1,2], Chan-Jong Kim[1,*]

[1]Department of Earth Science Education, Seoul National University, Seoul, Republic of Korea

[2]Graduate School of Convergence Science, Seoul National University, Suwon, Republic of Korea

[3]Department of Computer Science, Korea National Open University, Seoul, Republic of Korea

Problem Statements

- Many teachers use technology in their classes.
- Microsoft PowerPoint including YouTube, and web-based 2D simulations have been used primarily so far.
- Recently, the use of mobile applications in instruction are increasing. Because mobile applications can be interacted with students directly, they are more effective for students.
- Research has shown that the proper use of technology improves students' learning (Delgado *et al.*, 2015).

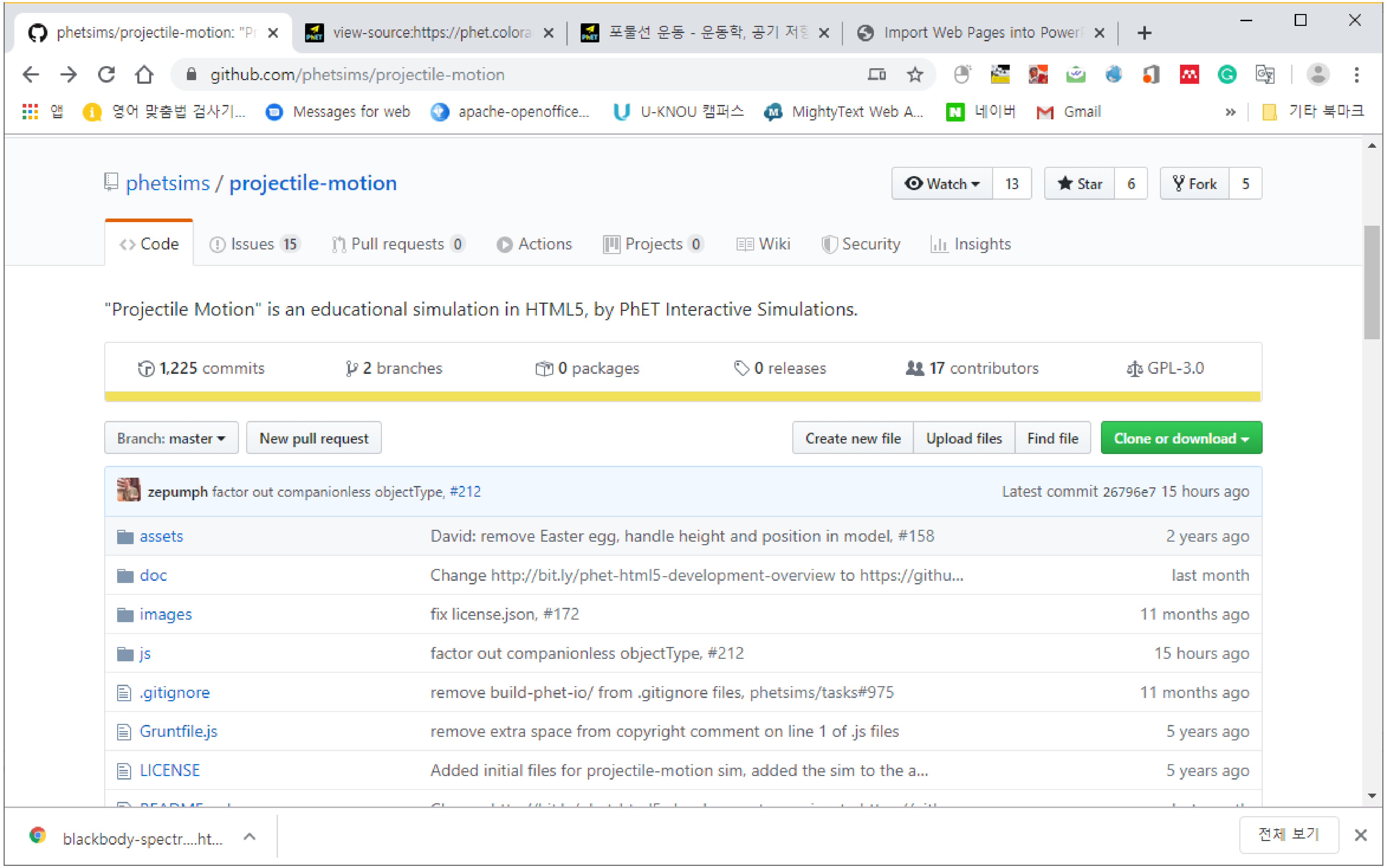
Problem Statements

Microsoft PowerPoint including YouTube, and web-based 2D simulations are easy to freely change as teachers want, however it's hard to modify mobile applications to change as teachers need.

Opensource is prevalent now, so if you can develop mobile applications, you can modify it as you need.

If teachers do not have programming skills, they will be passive teachers who only use mobile apps that others have created. Their ability to design instruction will be limited due to their lack of technology competence.

http://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion_ko.html



PhET opens their source code in the GitHub. https://github.com/phetsims/projectile-motion

Problem Statements

- No programming course for science educators exists.
- There is already a **well-developed course**, in which many successful results, many patents, academic articles, and so on, were produced.
- This course developed for undergraduate students in **design majors**.
- We **adapt it to** the course for graduate students in the **science education majors**.

Goals

To develop an Introductory App making Course for science educators from the course for design majors

Research Questions

01

1. What **kind of difficulties** science education graduate students face (or meet) in the course?

02

2. What is the **major sources of difficulties** for science education graduate students in the course?

03

3. What **strategies was conducted** by the lecturer to solve the difficulties?

Course Information

- We apply the course into two different groups.
- Two courses were prepared
  - one for undergraduate students of design majors
  - the other for graduate students of science education majors

Title	Media Interaction Design (original course)	數學科學电脑融合教育 Fusion Education in Science Mathematics and Computer Technology (newly started course)
Participants	Undergraduate students of design major	Graduate students of science education major
Credits	3	3
Time	4 hours per week 15 weeks	3 hours per week 15 weeks
Instructor	Visiting assistant professor (客員□ □ □) - Major: Industrial Design - Project Designer of Hyundai Motor Company - Computer Programmer, Data Scientist	

App-making courses for design major in SNU

Two kind of lectures were mixed:

1) Learning how to make mobile apps
2) Learning how to design the products.

Week	Process	Example
1	Warm Up & Orientation	
2	Project Introduction	Introducing previous app projects
3	Project Description Block Coding with #Scratch/Inventor	Example of app samples with practice (Do-it-like)
4	Interview & Target	Definition of user with persona
5	Idea Generation	Extracting insights from user
6	Project Analysis Generative Coding with #Protopie	Definition of problem using Protopie to try pre-prototyping
7	Midterm Presentation	Whom and which to design?
8	Conceptual Design with Theory of Multiples	Concept for data app with sensors
9	Design Development	Value management
10	Kiosk Implementation and Exhibition	Open discussion with design
11	Applying Feedback (Control)	Applying feedback from the audience
12	Writing (WAC support)	Reporting troubleshoot to innovate
13	Prototyping / Final Publishing with #Ionic Starter	Final app producing
14	Test & Evaluation	Review and feedback
15	Final Presentation	Register the app to Google Play/iTunes

Industry-academic Cooperation (產學協同研究)

- SK* Creative Challenge 2019
- SK's creative development program with the university to foster converged talent who excel in IT, humanities and art.
- Our course is funded KRW 20,000,000 (=TWD 512,820) by SK for our two courses.

*SK: the conglomerate(大企業) in Korea

Industry-academic Cooperation (產學協同硏究)

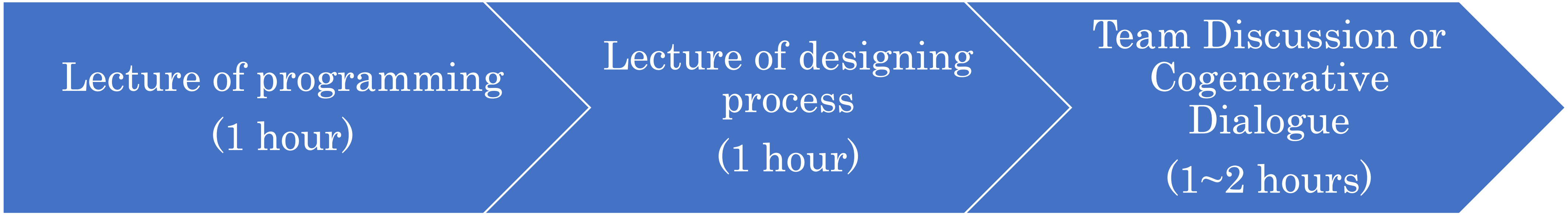
- Students of five university participate the final presentation.
- Only three teams in SNU will be able to participate in the final presentation.
- SK awards the best teams.
- SK recruits talented students in their internship.

Methods

- After each class, we had a co-generative dialogue(cogen) session to examine students' experience during the class.
- Co-generative dialogue(共同生成的對話)
  - Cogen is one of the teaching and learning strategies, as students and researchers gather to examine and reflect on the lecture of the day after the class (Roth, Robin, Zimmermann, 2002; Tobin, 2006).
  - Cogen helps the instructor understand the difficulties that participants faced, reflect on that and immediately improve the next class.
- Cogen sessions operated by researchers without the instructor.
- 2~3 students participated in a co-generative dialogue session per week.
- To date, one cycle of Cogen has been completed for half a semester.

Methods

- Plan of Cogen
  - The cogen session was done two teams per day at the end of the class.
  - Each team participated in cogen for about 30 minutes.
  - The participants of cogen were one researcher and 2~3 team members.
  - The researcher wrote field notes, and all the dialogues were recorded.
  - The instructor did not participate in the cogen session for the safety of students.



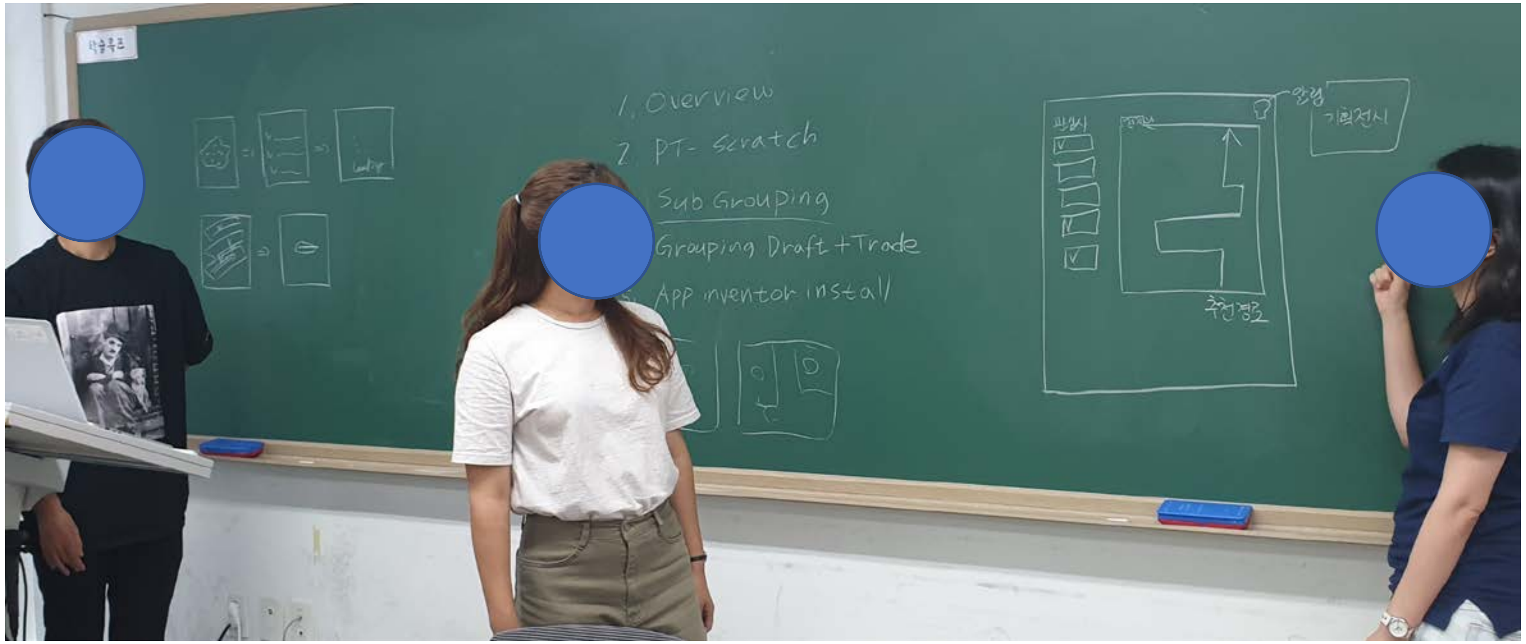
Course Flow

Course open → Kick off workshop (1 night 2 days) → The First Half of the semester → Midterm Presentation → Researchers and Instructor meeting to reflect the result of cogen → The second half of the semester → Final Presentation → Participating SK Creative Challenge (12/2)

Results

- Implementation of the first half of the course

Week	Planning	Implementation
1	Warm Up & Orientation	Ice-breaking, team grouping, survey
2	Project Introduction	Holiday (Thanksgiving day, 秋夕)
3	Project Description Block Coding with #Scratch/Inventor	Introducing previous app projects Learning Scratch Team discussion about their projects
4	Interview & Target	Learning App-inventor Team discussion about their projects
5	Idea Generation	User-centered Research - Ethnography Research - Debriefing - How to interview users
6	Project Analysis Generative Coding with #Protopie	How to make prototype - Marvel
7	Midterm Presentation	Midterm Presentation



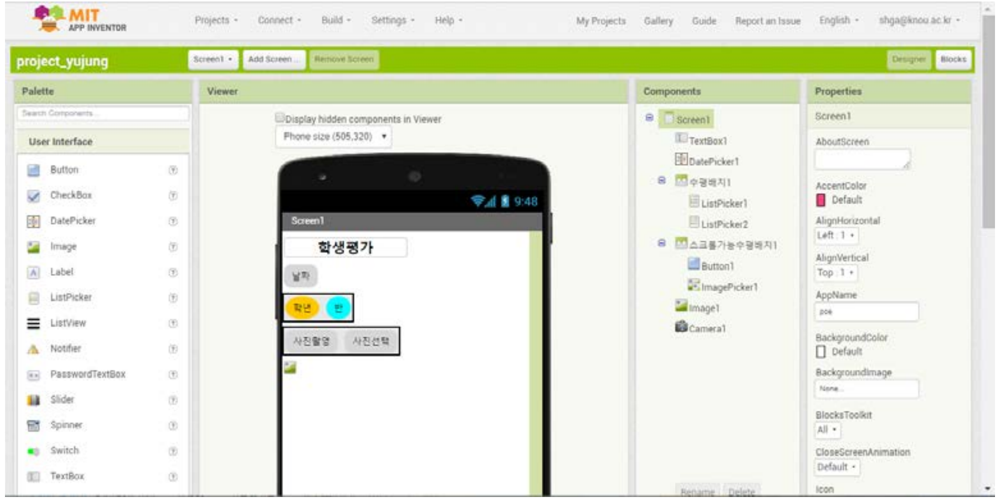
Results

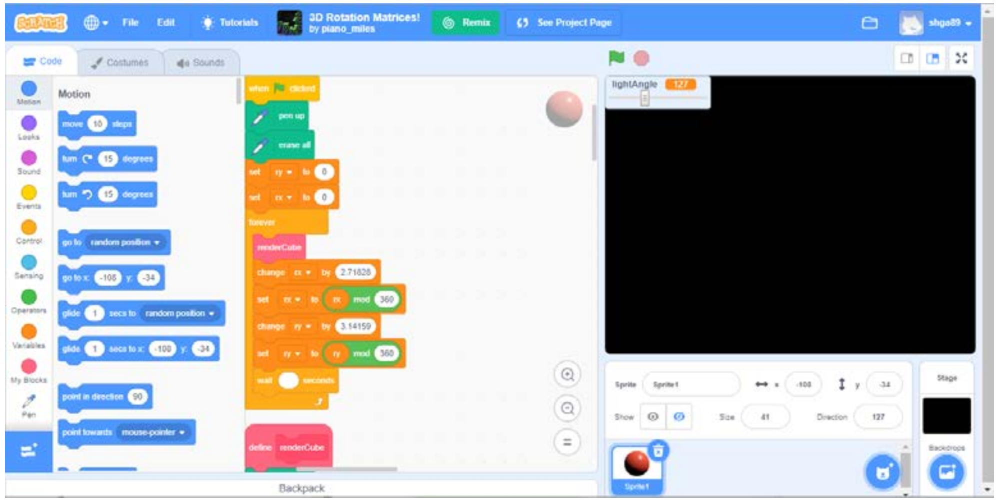
The first half of the course

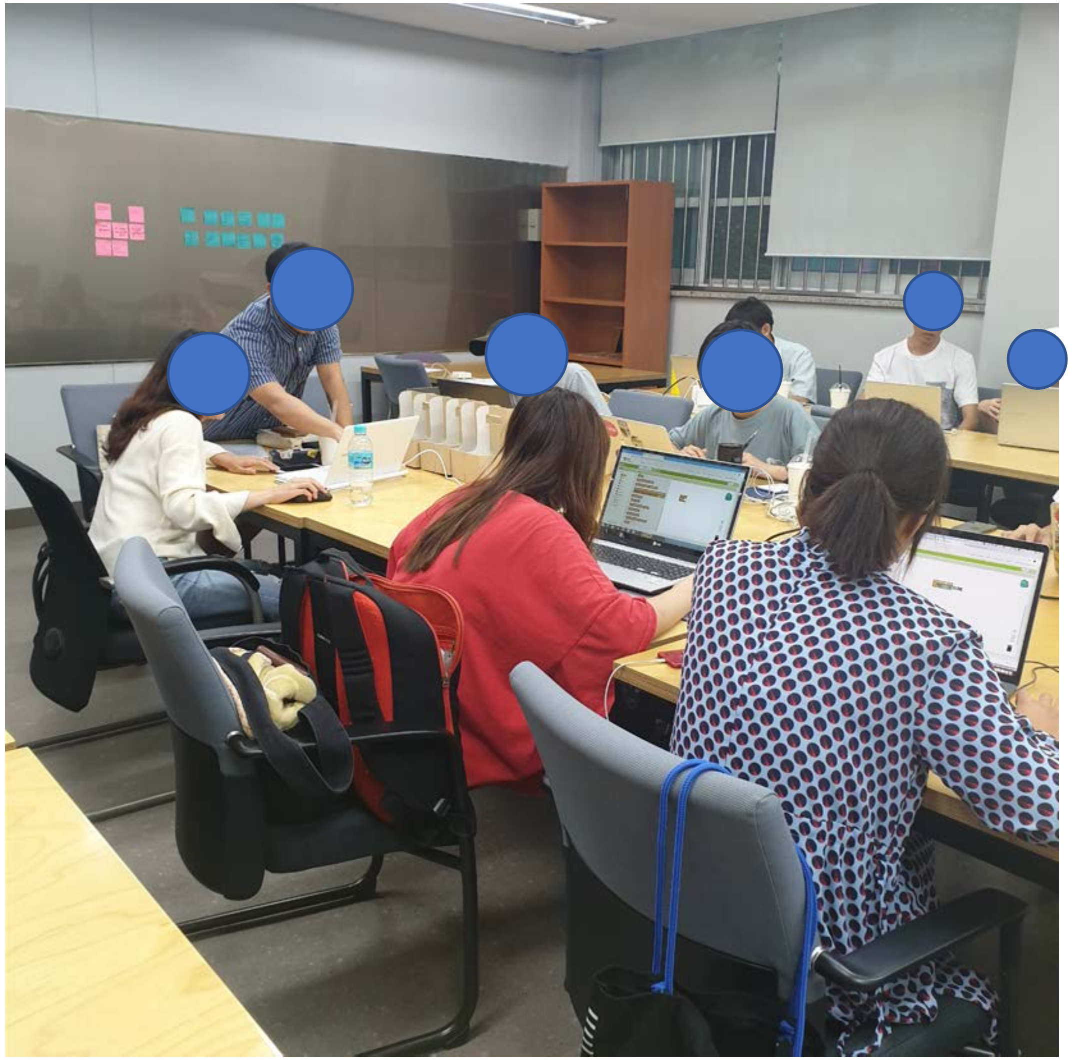
Grouping teams, Kickoff meeting (with SK)

In kickoff meeting – brainstorming, sharing ideas

- The first half of the course







To understand principles of programming, Scratch and MIT App Inventor were educated.

Results

- The first half of the course
  - **Different responses**

	Design major (undergraduate students)	Science Education major (graduate students)
Common responses	• A lack of announcement related to lecture plans, and assignments. • The satisfaction of learning design thinking	
Different responses	• Expectations of participating SK challenge. • The satisfaction of project-based learning	• High anxiety (不安感) of programming • Rare opportunities for learning programming • The low ability of TAs • The dissatisfaction of learning programming • Too much time consumption

Results

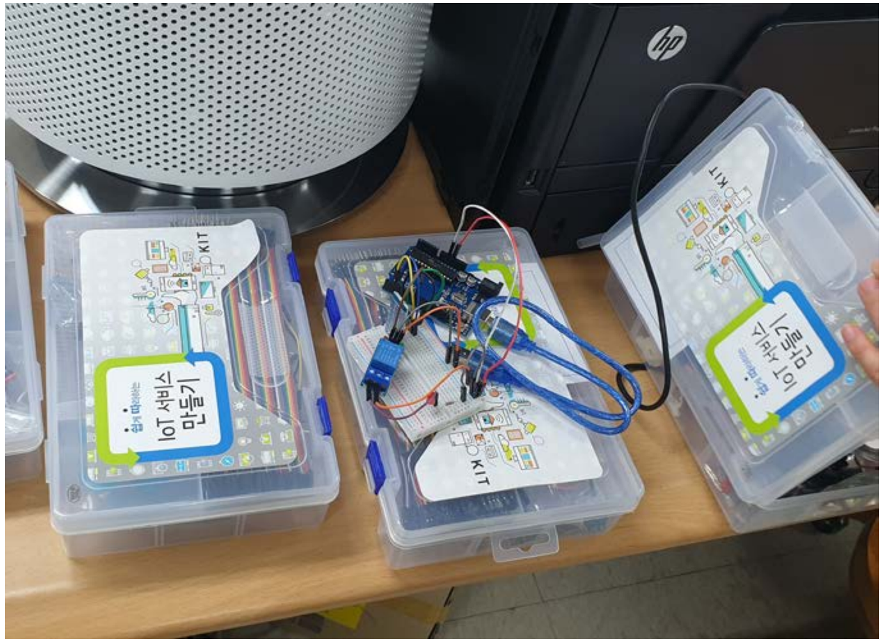
- The first half of the course
  - **Different aims**

	Design major (undergraduate students)	Science Education major (graduate students)
Personal Aims	• To make innovative products. • To participate outside activity • To develop my projects which is already started • To learn HCI, coding, design thinking	• To make mobile applications about educational assessment • To have better abilities than students • To learn programming (for his interest) • To get a compulsory credit (必須) *I want to learn how to make mobile applications. I don't want to make innovative mobile applications.*

Results

- Change of course plan

#	Problem	Solution
1	• High anxiety (不安感) of programming • Rare opportunities for learning programming • Dissatisfaction with learning programming	• Extend the time to practice programming • Supplementary lessons for teams who need • Change lecture plans, excluding Ionic Starter and Android Studio.
2	• The low ability of TAs	• Supplementary lessons for teams who need
3	• Too much time consumption	• Shorten the time of cogen
4	• A lack of announcement	• Post notification, and lecture notes on LMS system



Results

The second half of the course

Preparing and participating the final presentation.

Three times will participate the contest. (12月 6□)

Results

- The second half of the course
  - Eagerness to participate in the contest, SK Creative Challenge

	Design major (undergraduate students)	Science Education major (graduate students)
Eagerness to participate in the contest	• Students thought it was a good opportunity. • Most of the teams wanted to participate in the contest. • Very competitive for the right to participate	• Most of the teams did not want to participate in the contest. *It is right to yield opportunities for young people.*

Results

- THE PROBLEM IS "MOTIVATION". Students often wondered why they do. This seems to be due to a lack of notification, and different aims.
  - Students in design major **wanted to learn design thinking and make innovative products.**
  - However, students in science education major **wanted to learn programming itself** for teaching students or satisfying their interests, not make innovative products.

	Design major (undergraduate students)	Science Education major (graduate students)
Personal Aims	• To make innovative products. • To participate outside activity • To develop my projects which is already started • To learn HCI, coding, (user) interaction, designing process	• To make mobile applications about educational assessment • To have better abilities than students • To learn programming (for his interest) • To get a compulsory credit (必須)

Results

- Next week, we will conduct a survey for the one-semester class.
- Based on the research of this semester, the revised course will be taught to undergraduate students in science education majors in the next year.

Conclusions

1. What **kind of difficulties** science education graduate students face (or meet) in the course?

High anxiety of programming

Too much time consumption

2. What is the **major sources of difficulties** for science education graduate students in the course?

Different aims – They want to learn only "mobile programming."

Low motivation – Students often wondered why they do.

3. What **strategies was conducted** by the lecturer to solve the difficulties?

Extend the time to practice programming

Offer the supplementary class.

Shorten the time of other activities

Discussions

- The **learners' characteristics** that should be considered in class design are **more diverse** than previously thought.
- For meaningful activities, all activities must **motivate** students, so they can understand why they do that.
- To help students feel comfortable, the instructor must **show the possibilities they can reach the goals**.
  - The detailed notification is one of the solutions.

Implications

- Existing technology-related classes **cannot be applied directly** to students of science education majors. It should be properly modified.
- In organizing the courses, considering **learners' characteristics is a very important factor to make success.**
  - Different major makes different needs.
  - It is necessary to design courses fit students' needs.
  - Needs to consider their social status.

Thank you

謝謝你的傾聽

감사합니다