Feng Chia University
Outstanding Academic Paper by Students

2024 Technology Innovation Application Model - Pokémon EAT

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Abstract

In recent years, Taiwan has achieved a remarkable 99% adoption rate of school lunches in elementary and middle schools. Despite this widespread implementation, concerns have been raised about the nutritional quality and appeal of these meals. The Child Welfare League Foundation's "2023 Survey Report on School Lunches in Taiwan" highlights significant issues, including high levels of food wastage and student dissatisfaction with meal options. Many students reported leaving substantial portions of their meals uneaten, particularly vegetables and staple foods, due to repetitive menus and excessive greasiness. Additionally, while students generally understand the importance of nutrition, they lack detailed knowledge about dietary requirements and the relationship between diet and health. In response, Taiwan's Ministry of Education is investing NT$20 billion over four years to enhance digital education, providing 61,000 tablet computers to schools. This initiative aims to improve students' nutritional knowledge and promote healthier eating habits through digital learning tools. This paper proposes a solution to these challenges through the innovative use of technology, specifically the Pokémon EAT gamification. This approach combines gaming with nutrition education to engage students and enhance their understanding of healthy dietary choices.

Keyword： Taiwan, school lunches, nutrition, food wastage, student satisfaction, digital education, Ministry of Education, Child Welfare League Foundation, Pokémon EAT, gamification
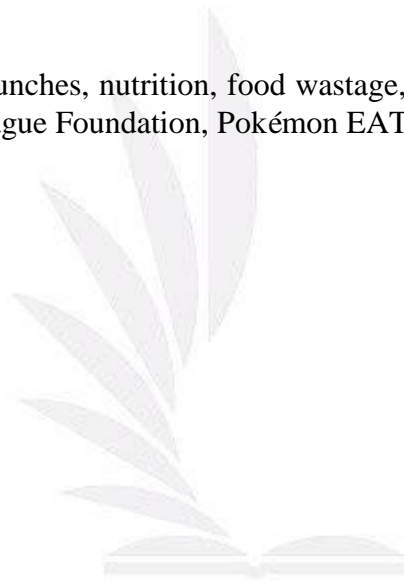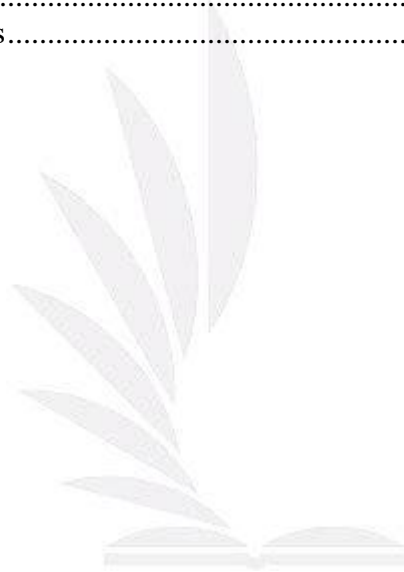
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Chapter 1 Identify problems and general solutions.

1.1 Introduction:

In recent years, Taiwan has seen a significant rise in the prevalence of school lunches among elementary and middle schools, with a staggering 99% adoption rate. However, despite this widespread provision of meals, concerns have been raised about the nutritional quality and appeal of these lunches. The Child Welfare League Foundation (CWLF) conducted a comprehensive survey, the "2023 Survey Report on School Lunches in Taiwan," which shed light on various challenges and perceptions regarding school meals.

According to the CWLF report, a notable issue highlighted was that many school lunches were deemed neither nutritious nor delicious by students. The survey revealed concerning trends such as significant food wastage, particularly with vegetables and staple foods like rice and noodles. A substantial portion of respondents reported leaving behind a quarter to over half of their servings uneaten. Moreover, a considerable percentage of students expressed dislike for certain dishes, tastes, and textures, citing concerns about repetitive menus and excessive greasiness.

Despite an overall positive attitude toward nutrition, elementary school children showed a limited understanding of how dietary choices impact health. The report indicated that while students recognized the concept of a balanced diet, they lacked detailed knowledge about daily food requirements and the relationships between diet, nutrients, and health outcomes. This knowledge gap could hinder their ability to make informed food choices and maintain a balanced diet.

In response to these findings, Taiwan's Ministry of Education is taking proactive steps to enhance digital education in schools. With a focus on the upcoming semester, the ministry plans to invest NT$20 billion over four years to provide 61,000 tablet computers to elementary and junior-high schools. This initiative aligns with the broader digital education strategy of the Executive Yuan, which has previously allocated funds to improve Internet access and equip smart classrooms in educational institutions across the country. By integrating digital tools and resources, Taiwan aims to empower students with a deeper understanding of nutrition and encourage healthier dietary habits among the younger population.

1.2 Problem statement:

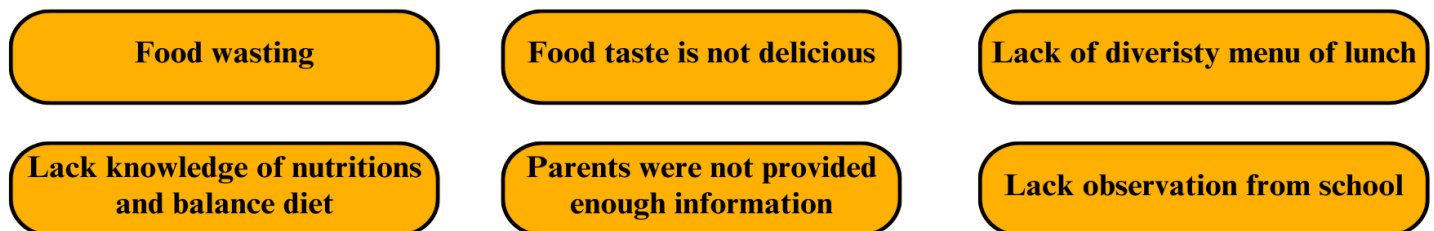| Food wasting	Food taste is not delicious	Lack of diveristy menu of lunch
Lack knowledge of nutritions and balance diet	Parents were not provided enough information	Lack observation from school

Figure 1 Problem statement

1.3 Objectives:

The primary goal of this proposal is to develop an AI-Powered Providing Nutrition Knowledge Application that will:
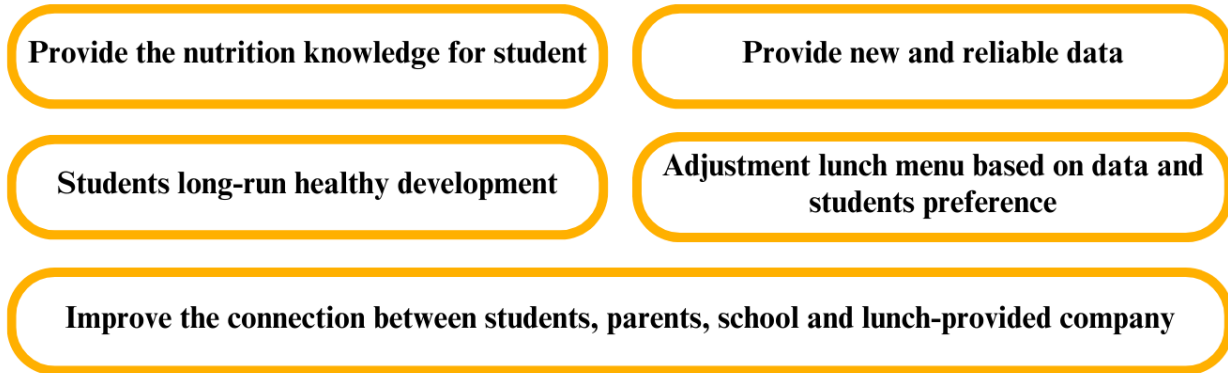
- Provide the nutrition knowledge for student
- Provide new and reliable data
- Students long-run healthy development
- Adjustment lunch menu based on data and students preference
- Improve the connection between students, parents, school and lunch-provided company

Figure 2 The primary goals of this innovation

Chapter 2 External Analysis

2.1 PESTEL analysis:

This project will focus on the economic, social, technological, environmental, and legal aspects of PESTEL analysis.

Economic	Reducing food loss in Taiwan could positively impact economic growth by improving resource efficiency, reducing production cost, and increasing agricultural productivity.
Social	• **Health consciousness:** Obesity, hypertension, and a high level of cholesterol are problems facing one out of every four or five kids in Taiwan. • **Lifestyle attitude:** MOE jointly undertake community-based healthy eating education and environmental protection activities. • **Age distribution:** Perceived ease of use and learning enjoyment were the primary reasons for elementary teachers in Taiwan accepting the use of digital game-based learning in their teaching. • The government is promoting healthy eating and lifestyle habits among students by ensuring schools provide nutritious meals and nutrition education.
Technological	• To promote students' abilities for lifelong learning, the ministry suggests that students "Acquire the ability to utilize technology and information". • Taiwan's Ministry of Education developed iPad devices to schools across the country.
Environmental	Food waste is a waste of social resources, and causes environmental pollution and ecological damage.
Legal	It is legal to apply digital game in Taiwan education system based on The Digital Learning Enhancement Plan for Grade 1-12 students.

Table 1 PESTEL Analysis

PESTEL's analysis indicates that Taiwan's government supports students using digital devices, beginning with elementary school students; moreover, the country's food loss and national health challenges require a high level of attention to food through school lunches targeted at students. The Ministry of Education in Taiwan provides students with the opportunity to use and learn on iPads, and the application of digital games to education is legal under Taiwanese law.

Overall, this analysis shows that the use of digital games through iPads and other devices in Taiwan could lead to food loss reduction and health in the future.

2.2 Consumers analysis:

The result revealed that the huge numbers of students did not prefer the lunch taste and the vegetables. Hence, with the launching out of app we could incentive the students to finish their lunch; meanwhile the data from apps could provide to school and lunch-provided companies as feedback to adjust the menu.

Students experience of lunch in school

POKÉMON EAT

Agree Disagree

- Not eating enough food for school lunches: **81%**
- Eating less than their regular meals: **47%**
- Completely consumed dishes
- Disliked dishes: **75%**
- Hate vegetables: **65%**
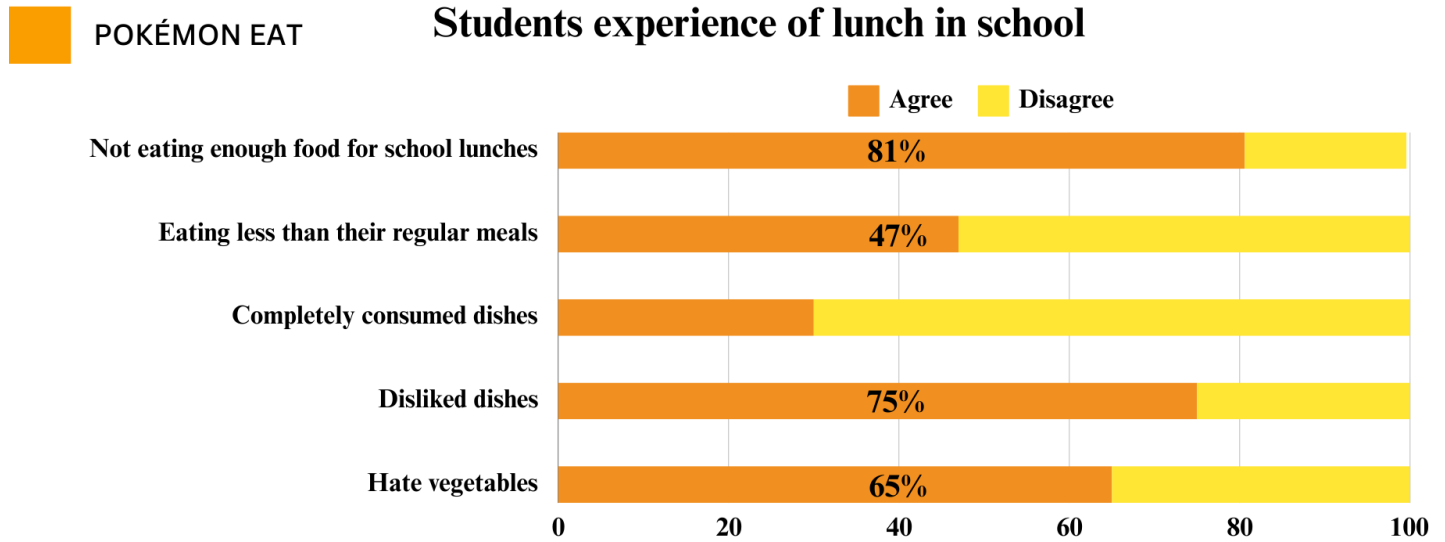
Figure 3 Students experience of lunch in school

The result revealed that 65% parents did not know that they can report about quality of lunch school. Moreover, the percentage of parents did not know their children having lunch at school is still high. Hence, with the launching out of app we could build up the relationship between parents and school. Additionally, the parents could observe the data to know more about their children diet.

Parent participation

POKÉMON EAT

Yes No

- Know their children have lunch: **25%**
- Know only menu: **42%**
- Foreign objectives and food poisoning
- Can report lunch quality: **65%**

Figure 4 Parents participation

3.1 Wireframe model: The application basically relates to nutrition education.

From the school's perspective: The school will provide the menu of food at lunch time and upload it to the system. After the use of students, the school could collect the data and information of food that students ate on that day. Data could be used to manage the nutrition adopted by students, the quality of food which is suitable to students and report the results to parents for observations purpose. It will reduce wasting food due to the incentive from games.

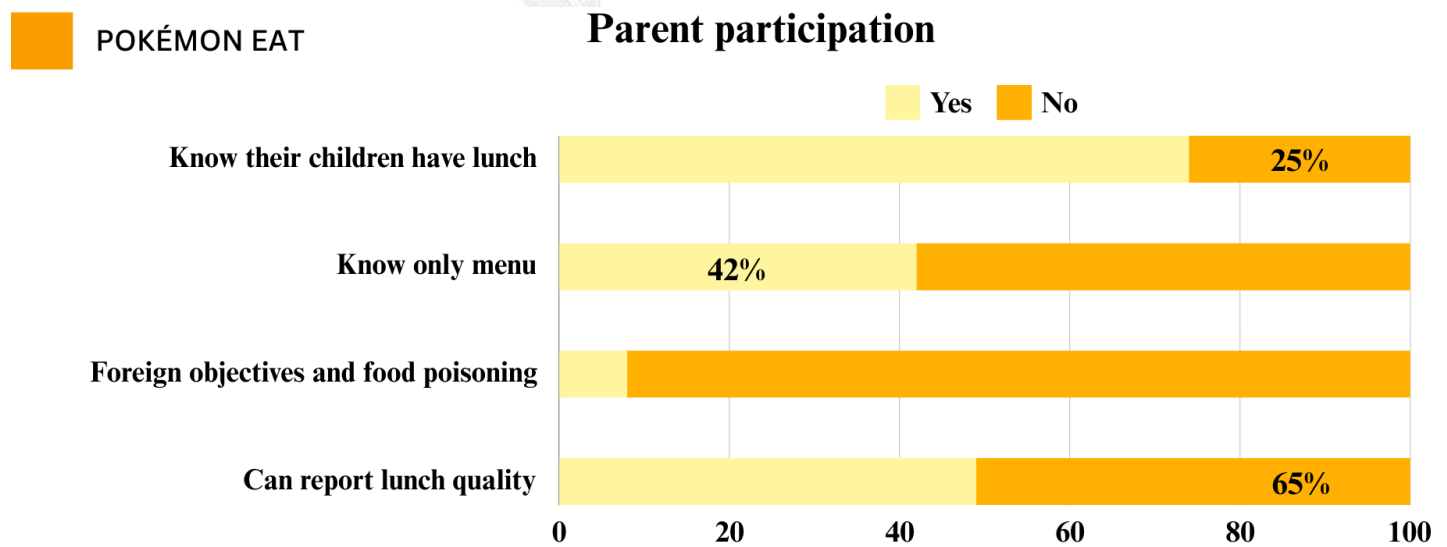**From students' perspective:** They train passively about nutrition knowledge and practice through the test before starting the game. It will enhance their health habits and knowledge which would help them to know more about their future fitness. Besides, motivating the students to eat food that they do not like and approach the technology earlier.

From the company's perspective: They could use the data to adjust the menu, attract more corporations from school and receive the support from the government due to following Lunch Content regulations.

3.2 Structure and Design of product:

There are two main parts in the application:

→ **AI scanning technology**: which helps the school to collect data and information about students eating results. Meanwhile, the students can collect Pokémon characters for their game.

→ **Gamification**: which helps the students to remember basic information of food that they eat. Whereas the school can test their knowledge through the test before starting the game and the power of each Pokémon equilibrium to the calories of each food (for example).

3.3 Solid model - Internal workings:
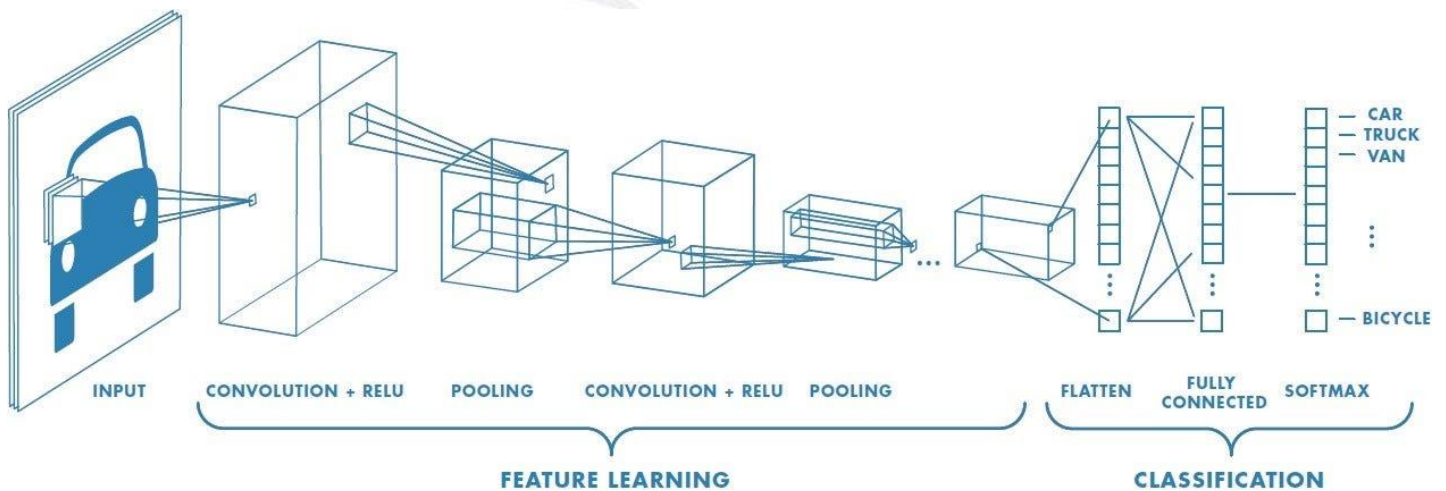
Figure 5 Deep learning - (CNNs)

Technology: Deep learning-based methods - convolutional neural networks (CNNs)

→ Recognize the items in the picture and identify the categories.

→ Recognize the difference between before and after images to identify the food eaten.

In this case, Figma works as a UI/UX Design of Pokémon EAT application. It demonstrates exactly the ideal applications and inside functions that we would like to provide to consumers. Link to experience our application
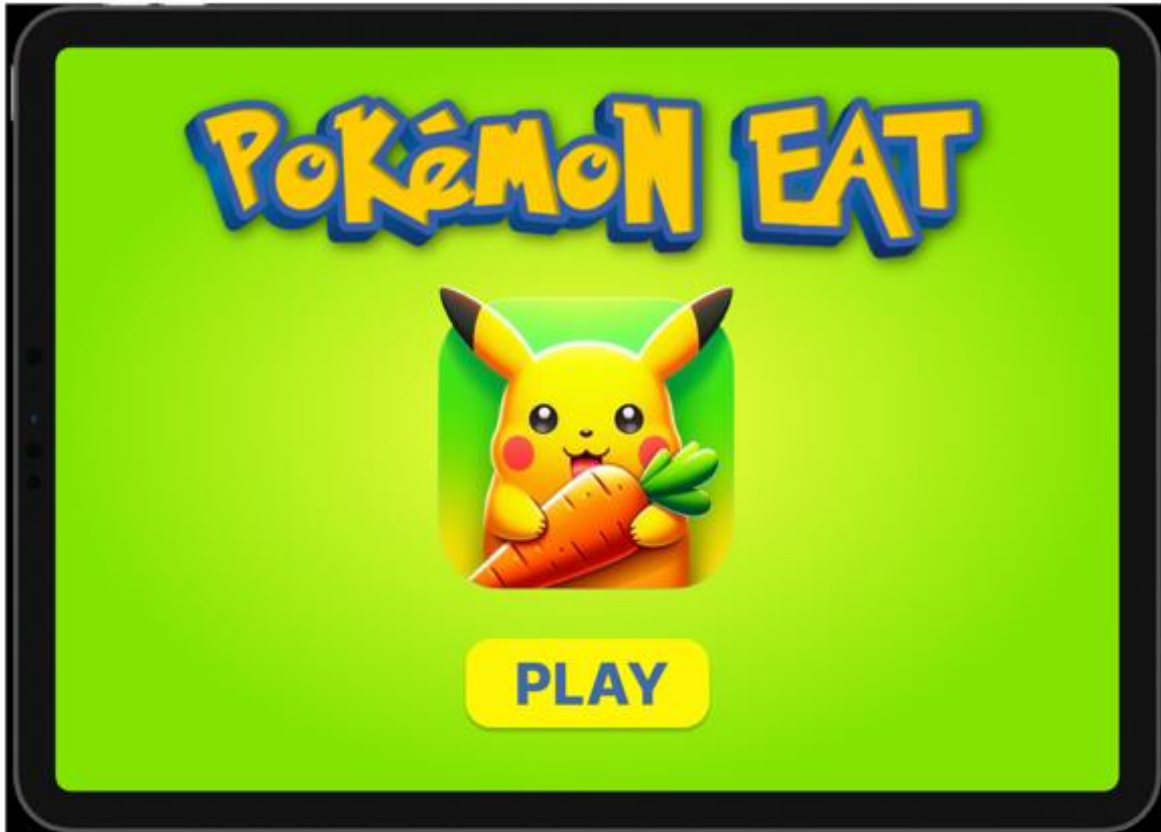
Figure 6 Opening screen
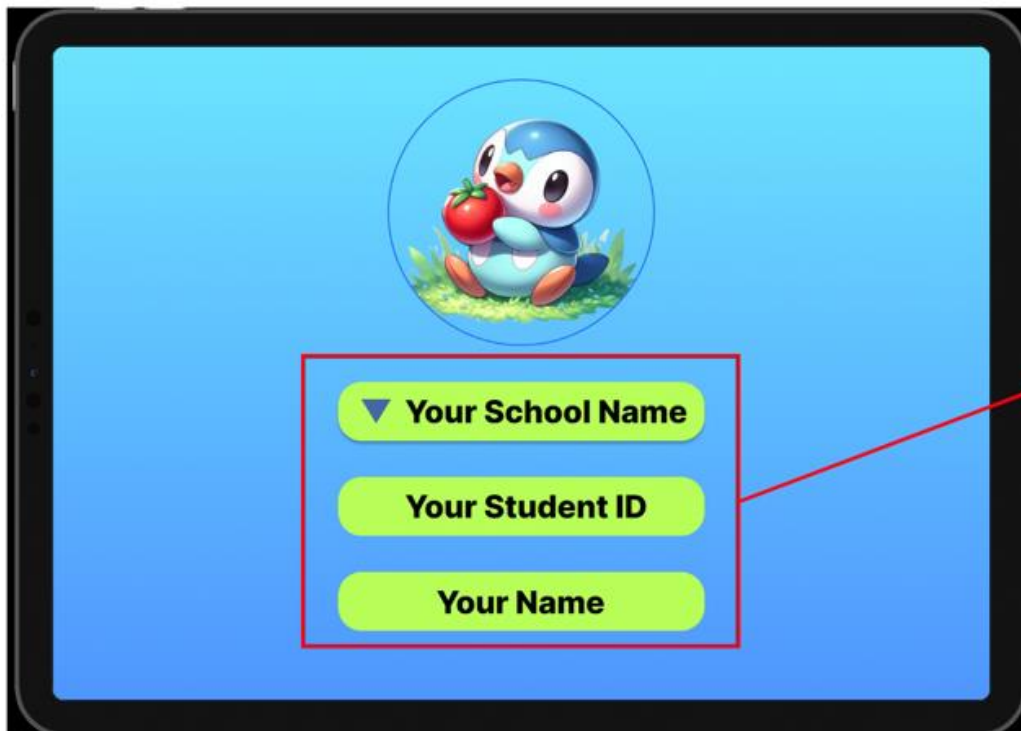
Login Information
It can be used by entering the school name, student ID and name on the login screen.

Figure 7 Log in or Register screen

Scan function

By activating this function after finishing a school lunch and scanning the lunch plate, they can find out the nutrition and calories contained in that day's school lunch, and they will receive a Pokémon for completing a plate of either a main dish or a side dish.

Figure 8 Explanation of scanning function
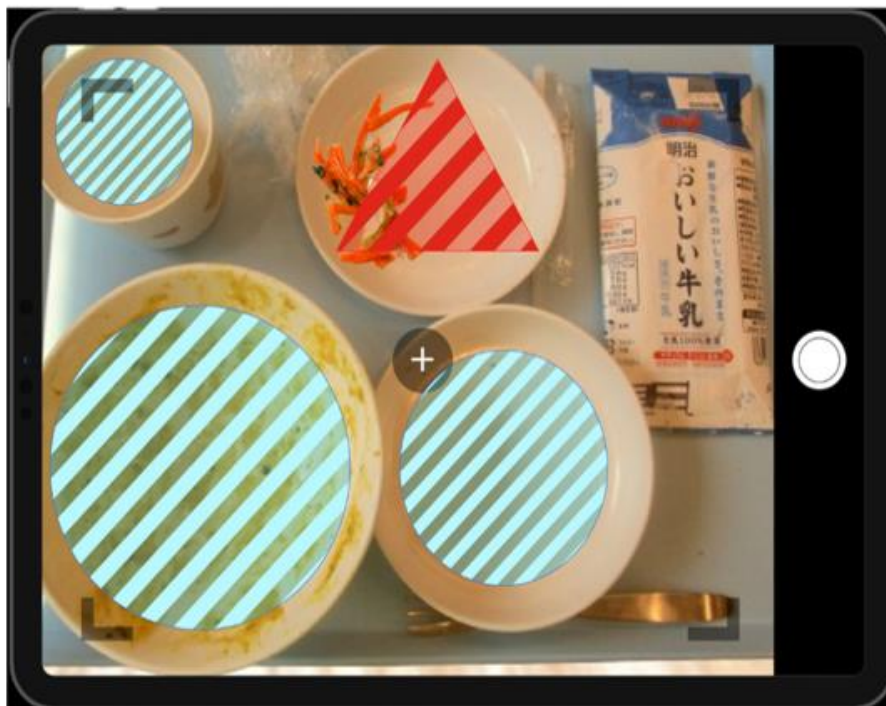
A plate with no food left over.

A plate with food left on it.

Figure 9 Demonstration of scanning results
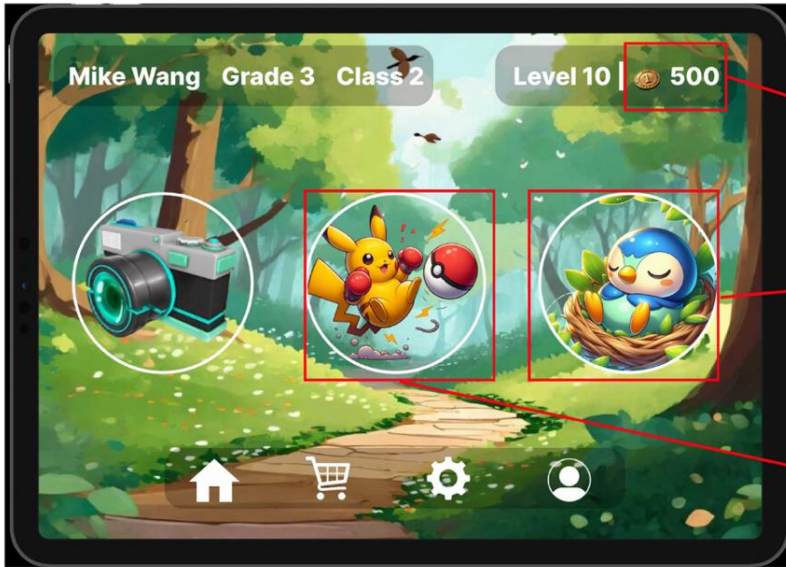
Coins

Coins can be obtained by completing school lunches, and the coins earned can be used to strengthen Pokémon or be used to shop at the store.

Nurturing Games

This is a nurturing game in which they can change Pokémon's clothes and raise them.

Fighting Games

This is a game in which they can play against each other using the Pokémon they have acquired, and they can also use coins to strengthen their Pokémon.

Figure 10 Explanation of entertaining functions

Pokémon

Pokémon obtained from school lunches.

Nutrition Knowledge

They can learn about the nutrients and calories contained in the dishes they have completed from this screen.

Figure 11 Nutrition knowledge screen and Pokémon obtained
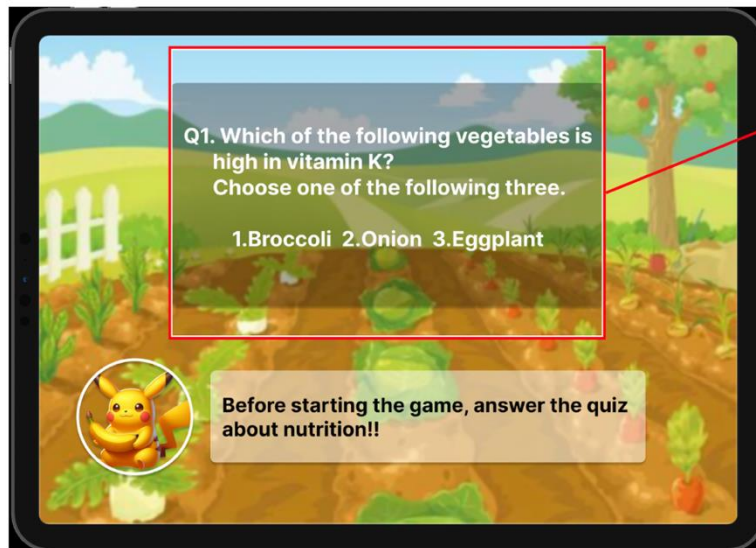
Quizzes about food nutrition

Before starting a fighting or nurturing game, they must answer a total of five quizzes about food nutrition, and they must answer all questions correctly to play the game. They can try the quiz as many times as they want.

Fighting Games Screen

Figure 12 Quizzes about food nutrition

4.1. Working model:

We interviewed the Shang' an elementary school student in Taiwan about our desire using app such as:

- Would you be willing to finish your school lunch to play this game?
- Before play the game students must take the small quiz about nutrition, will you willing to answer it?
- If there was a chance to use this game in a biology class etc. in the future, would you be happy to learn?

And then using that information to revise the app.

Figure 13 Implementing interview

Chapter 5 Creativity and value of the work

5.1 The social value created by the work:

5.1.1 Issues and tasks to be improved:

There are three main issues concerning the leftover school lunches among primary and junior high school students in Taiwan.

➔ **Children waste school lunches**: Use the app's scan function to have students scan their finished school lunch and give one Pokémon to each student who finishes either the main or side dish of the school lunch.

➔ **School lunches do not taste good**: Share menus among schools to determine which menus are popular with students and which are not. By providing this information to schools or lunch-provided companies, popular menu items can be proactively incorporated, leading to improved taste and food loss.

➔ **Lack of knowledge about nutrition**: Our app includes a game that can be played with the Pokémon they get. Students must answer a quiz about nutrition before they can play with the Pokémon they got after finishing their school lunch.

5.1.2 Goal Setting:

Our goals encompass two main areas: Children's health and Improving food loss.

→ **Minimize leftover school lunches to align with Sustainable Development Goals (SDGs) Target 12.3:** By optimizing meal consumption, we reduce waste and contribute to sustainable practices.

→ **Enhance children's nutritional knowledge:** We aim to empower students with the understanding to make healthy dietary choices throughout their lives, integrating nutrition education into the curriculum and fostering a culture of nutritional literacy.
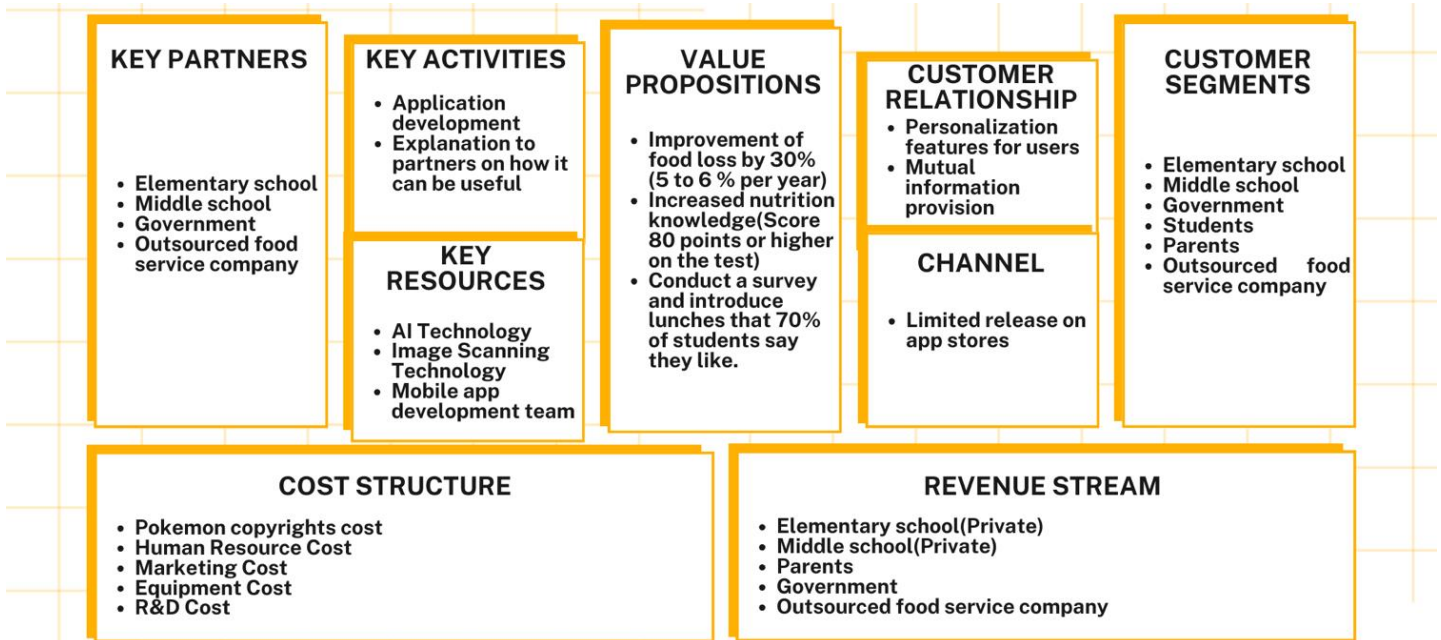
5.1.3 Business Model:

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIP	CUSTOMER SEGMENTS
• Elementary school • Middle school • Government • Outsourced food service company	• Application development • Explanation to partners on how it can be useful **KEY RESOURCES** • AI Technology • Image Scanning Technology • Mobile app development team	• Improvement of food loss by 30% (5 to 6 % per year) • Increased nutrition knowledge(Score 80 points or higher on the test) • Conduct a survey and introduce lunches that 70% of students say they like.	• Personalization features for users • Mutual information provision **CHANNEL** • Limited release on app stores	• Elementary school • Middle school • Government • Students • Parents • Outsourced food service company

COST STRUCTURE	REVENUE STREAM
• Pokemon copyrights cost • Human Resource Cost • Marketing Cost • Equipment Cost • R&D Cost	• Elementary school(Private) • Middle school(Private) • Parents • Government • Outsourced food service company

Table 2 Business Model

5.1.4 Target Audience:

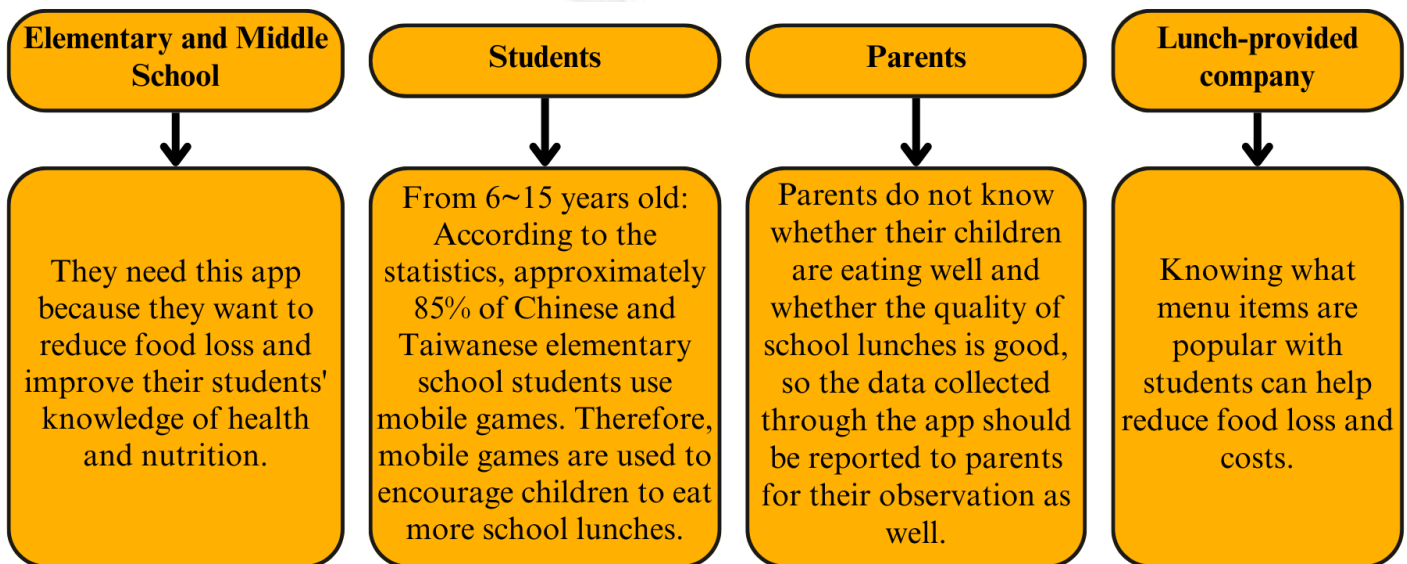| Elementary and Middle School	Students	Parents	Lunch-provided company
They need this app because they want to reduce food loss and improve their students' knowledge of health and nutrition.	From 6~15 years old: According to the statistics, approximately 85% of Chinese and Taiwanese elementary school students use mobile games. Therefore, mobile games are used to encourage children to eat more school lunches.	Parents do not know whether their children are eating well and whether the quality of school lunches is good, so the data collected through the app should be reported to parents for their observation as well.	Knowing what menu items are popular with students can help reduce food loss and costs.

Table 3 Target Audience

5.1.5 Evaluation of potential social influence (Expected Benefits and Costs):

➔ **Social Impact Score:** The teacher would sit in the back of classroom to ensure the students finish their lunches without throwing them away to scan and get the Pokémon as cheating method.

Impact Category	Impact Description	How to measure it	Processes and tools to use	Evaluation
Food Loss	Pokémon awarded for finishing school lunches can improve food loss by motivating students to finish their school lunches.	A survey to determine how much school lunch leftovers have decreased.	Data obtained through the application	Improve food loss by 30%
Nutrition Knowledge	Increased nutritional knowledge through Pokémon gained from finished school lunches.	Periodic testing to ensure that you have a solid knowledge base.	Data obtained through the application	Score 80 points or higher on the test
Identifying school lunches preferred by students	Sharing school menus can help identify popular lunch options, enabling food service companies to adjust menus and reduce food waste.	Satisfaction survey about school lunches.	Data obtained through the application	Conduct a survey and introduce lunches that 70% of students say they like.

Table 4 Social Impact Score

➔ **Expected Benefits:**

Short-Term (1 year)	Medium-Term (2-3 year)	Long-Term (5 year)
Enhance brand awareness	**Behavior change**	**Reduced food waste**
• Increased number of schools using the app: 500 • Improved brand recognition: 80%	• Increased number of students completing school lunches: 80% • Customer satisfaction: 80%	• Food waste rate: decrease 30% • Develop initiative to reuse surplus food.
Education reinforcement	**Accessibility and inclusivity**	**Prevalence in schools**
• App Usage: 30% increase • Improve the quality of the app in cooperation with educational institutions.	• Accommodating students with disabilities. • Satisfaction from those students: 60%	• Increased number of schools using the app: 2000~2400 • Customer satisfaction: 100%

Table 5 Expected Benefits

➔ **Expected Cost:** These estimates are reasonable estimates based on information from market analysis of the industry.

IMPACT CATEGORY	QUALITATIVE DESCRIPTION	QUALITATIVE INDICATOR	PROCESSES & TOOLS TO USE	EVALUATION
Human Resource Cost	Totals salaries paid to employees working on the app	Year salary	Industry salary reports or salary surveys	US$120,000
Equipment Cost	Cost of all equipment needed to develop and maintain the app	Total equipment cost	Vendor quotes or purchase orders	US$25,000
R&D Cost	Cost of research and development for the app	Cost of research projects and trials	Outsourcing price from consulting company	US$60,000
Marketing Cost	Cost of advertising and promotion for the app	Online marketing cost and sponsorship fees	Google SEO, Social Media Ads, Industry data	US$50,000
Pokemon License Cost	Cost of collaborate with Pokemon image	Pokemon image copyrights	License cost	US$75,000

Table 6 Expected Cost

Chapter 6 Implemented Plan and Expectation

6.1 Action plan and specific methods of improvement (Schedule & Techniques)

Action Plan in 2024 to 2025

Task	5/24		7/24		9/24		11/24		1/25		3/25		5/25		7/25	
Market research	▄	▄														
Identify user personas and stories			▄	▄												
Create technical requirements				▄	▄	▄										
Create business model				▄												
Partner with government						▄	▄									
Partner with outsourcing food service company						▄	▄									
Partner with schools						▄	▄	▄								
Prototype development								▄	▄	▄	▄	▄	▄			
Integrate AI technology, image scanning technology, and data collecting technology into the prototype of the app												▄	▄	▄	▄	

Table 7 Action Plan in 2024 to 2025

Action Plan in 2025 to 2026

Task	8/25		10/25		12/15		2/26		4/26		6/26		8/26		10/26
Examination period	▄														
App trial period		▄	▄	▄	▄	▄									
Launch the app							▄								
Conduct user surveys							▄	▄	▄						
Developing marketing plan							▄	▄	▄	▄	▄	▄	▄		
Continuous improvement								▄	▄	▄	▄	▄	▄	▄	▄
Collaborate with partners for promotion												▄	▄	▄	▄
Monitor and evaluate the performance of the app														▄	▄
Increase partner schools														▄	▄

Table 8 Action Plan in 2025 to 2026

6.2 Long-term Plan:

➔ **Spread the app to almost all schools in Taiwan:** By 2031, spread to more than 60-70% of elementary and junior high schools→2000～2400 schools. Improving the loss reduction rate of school lunch by at least 30%.

➔ **Improve the app for the public to attract more users:** Based on the success of the app for elementary and middle schools, the company will release an app for the public by 2033. Focusing on marketing and promoting the app to the public and reach 10,000+ users by 2034.

➔ **Spread the app to schools in other countries to improve food loss globally:** Based on the success of the Taiwanese program, launch a pilot program to introduce the app in selected schools in Asian countries by 2032. By 2037, the app will be introduced in more than 10 Asian countries to improve food loss reduction rates.
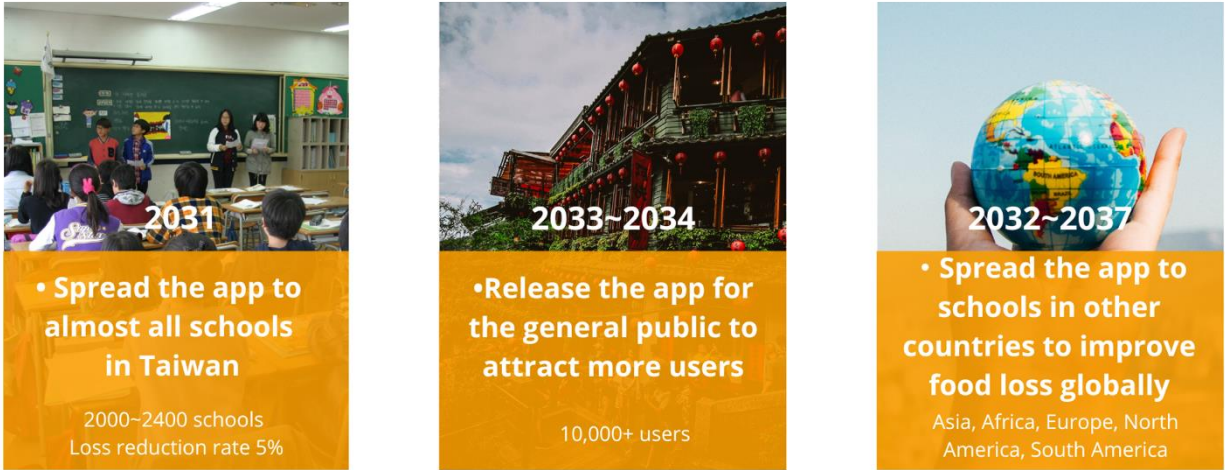
Figure 14 Long-term Plan

6.3 Creativity and uniqueness of the work (Before & After Analysis):

Table 9 Before Analysis and Implementation

Table 10 After Analysis and Implementation

Chapter 7 Profit Prediction

As the below demonstration, we estimate each user paying 100 for service, for example. The App Store or Google Play platform would take 30% from the price, after that we pay 50% for Pokémon license. At the end, we would have 35 NTD as revenue of each user.
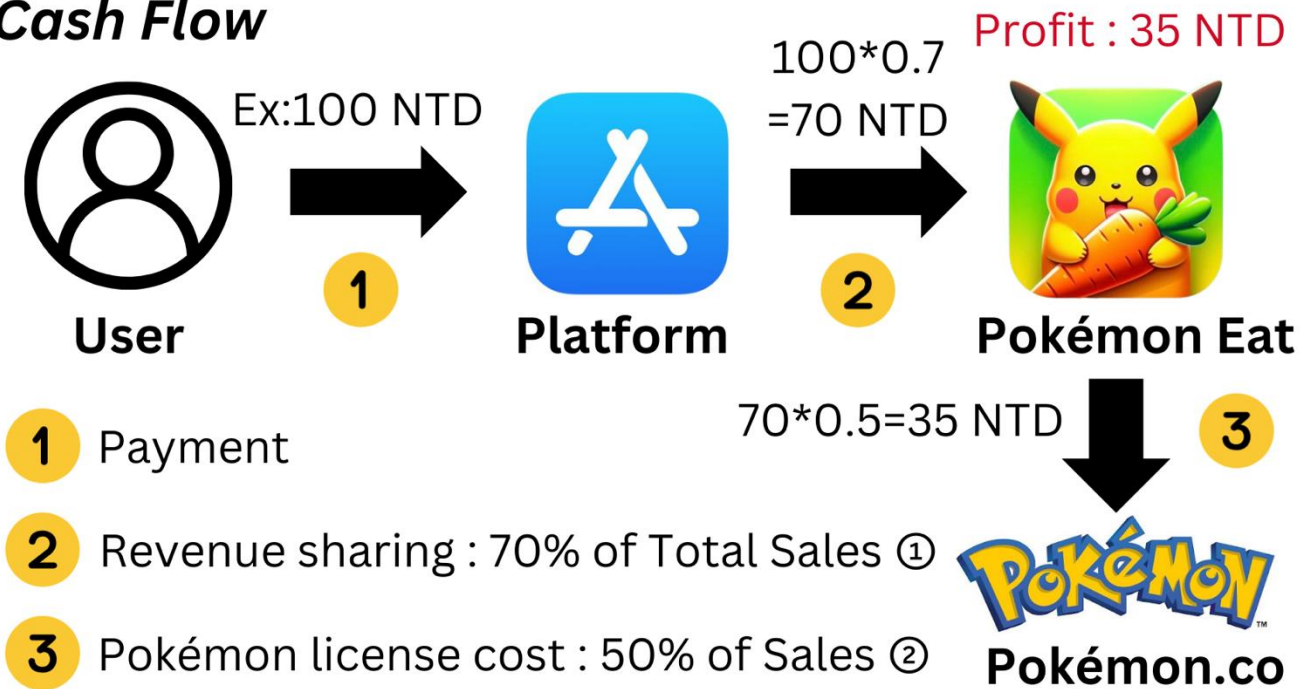
POKÉMON EAT
Cash Flow

User → Ex:100 NTD → **Platform** → 100*0.7 =70 NTD → **Pokémon Eat**

Profit : 35 NTD

70*0.5=35 NTD → **Pokémon.co**

1 Payment

2 Revenue sharing : 70% of Total Sales ①

3 Pokémon license cost : 50% of Sales ②

Figure 15 Cash Flow

POKÉMON EAT Profit and Loss Statement (2031)

Cost of Sales (Platform Cost) $10,619,507	Sales (School) $24,778,851
Pokémon License Cost $12,389,426	
Human Resource Cost $92,000	
Equipment Cost $25,000	
Marketing Cost $50,000	
R&D Cost $60,000	
Gross Profit $1,542,918	

Assumption
Public Schools : The government pays
Private Schools : Parents pay
Prevalence in Taiwanese schools : 70%
Source of income : Paid apps
Monthly fee : 100 NTD
The school pays for the period :
9 months out of 1 year

Total sales in 2031 : $35,398,358
Cost of Sales : 35,398,358*0.3=$10,619,507
Sales : 35,398,358*0.7=$24,778,851
Pokémon License Cost :
24,778,851*0.5=$12,389,426

Gross Profit $1,542,918

Table 11 Profit and Loss Statement (2031)

POKÉMON EAT *Profit and Loss Statement (2033)*

Cost of Sales (Platform Cost) $12,009,845	
Pokémon License Cost $14,011,486	
Human Resource Cost $92,000	Sales (School and General Public) $28,022,972
Equipment Cost $25,000	
Marketing Cost $50,000	
R&D Cost $60,000	
Gross Profit $1,774,641	

Assumption
• Release the app for the general public to attract more users (plus 10,000 users)
• Free trial for the first 2 weeks
Prevalence in Taiwanese schools : 80%
Source of income : Paid apps and Billing system
Monthly fee : 100 NTD
The school pays for the period :
9 months out of 1 year
The general public pays for the period :
12 months out of 1 year

Total sales in 2033 : $40,032,817
Cost of Sales : 40,032,817*0.3=$12,009,845
Sales : 40,032,817*0.7=$28,022,972
Pokémon License Cost :
28,022,972*0.5=$14,011,486

Table 12 Profit and Loss Statement (2033)

After settling down and having stable income steam for 2 years, the company would expand public. The previous income steam was estimated within 9 months due to working periods of the school. Meanwhile, the application for public would set up free-trial version (for the first 2 weeks). The users need to pay additional fee to release from restriction functions.

Chapter 8 Elevator Pitch

There are many types of calling for investment; however, Shark Tank is one of the most popular TV about investment with global versions from around the world. Hence, we believed that with this theme, our team could create best impression to professor and built up a perfect atmosphere of pursuing to all our college friends who were joining in practical investing action.
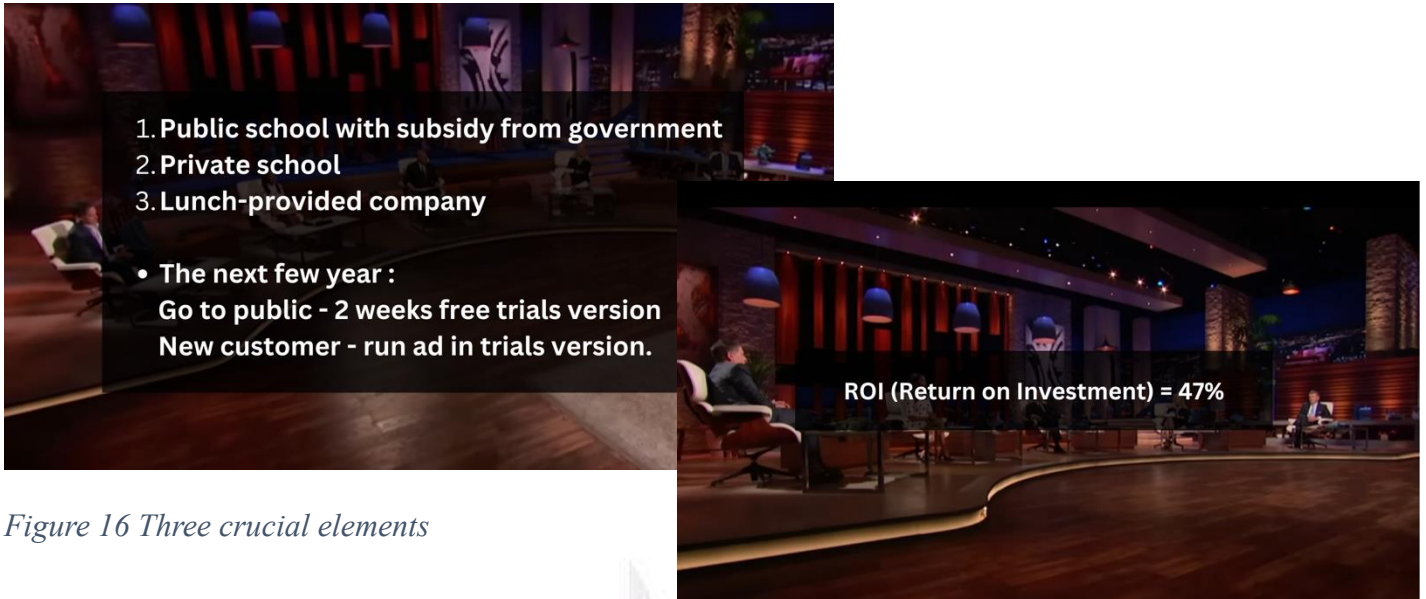
Figure 16 Three crucial elements

Due to the previous lecture coupled with invited guests from Biomedical Company Manager, we have practical situation of elevator pitch. Then he got advises to us when it comes to investment. There are three crucial elements needed to consider which are business evaluation, ROI, and operation business model. Based on this knowledge, we built up a scenario mentioning about these tree points.

Generally, a small business is worth 1-2 times its annual profit. However, this number can be higher or lower depending on the circumstances. If the business is in a high-growth industry, for example, it may be worth 3-5 times its annual profit (includes equipment and revenue). We determine our niche is kind of unique; therefore, it is reasonable to be third times of gross profit.

It is harder to estimate ROI, through the formular we calculate value of 1% share worth and then divide to opportunity cost then we could have ROI. Based on the high ROI (return on investment) and the information from sales and profits, the investors would be easier to estimate the opportunities the company would develop in the future. Hence, they make decision on investment.

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