



## Development of a campus-based intervention program to strengthen food literacy among university students: A qualitative formative study

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### ABSTRACT

**Objectives:** This study aimed to develop a campus-based intervention program to enhance food literacy (FL) among university students.

**Methods:** In the initial phase, we conducted a literature review of FL intervention studies and held in-depth interviews with university students to identify facilitators and barriers to improving and practicing FL. Expert counseling sessions were conducted with nutrition education, marketing, and service design professionals. The results of this phase led to the creation of an initial curriculum draft. In the second phase, a follow-up survey was conducted with young adults to assess the acceptability of the developed curriculum. After the follow-up survey, additional meetings were conducted with the aforementioned experts, and the curriculum was further refined based on their input.

**Results:** An 11-week FL intervention program was devised using constructs from the Social Cognitive Theory. The weekly curriculum consisted of 90-min theory-based and 90-min hands-on experience sessions. Three primary aspects of FL were covered: nutrition and food safety, cultural and relational dimensions, and socio-ecological aspects. Program highlights included cooking sessions for crafting traditional Korean desserts, lectures on animal welfare, insights into zero-waste practices, and communal eating experiences. Based on the study team's previous research, the program also addressed mindful eating, helping participants understand the relationship with their eating habits, and providing strategies to manage negative emotions without resorting to food. Yoga sessions and local farm visits were incorporated into the curriculum to promote holistic well-being.

**Conclusions:** This study elucidated the comprehensive process of creating a campus-based curriculum to enhance FL among university students, a group particularly susceptible to problematic eating behaviors and low FL levels. The developed program can serve as a blueprint for adaptation to other campuses seeking to bolster students' FL.

**KEYWORDS** food literacy, university students, nutrition education, formative study, curriculum development

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## Introduction

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Food literacy (FL), derived from health literacy, has recently gained prominence as a critical dietary competency [1,2]. FL is a concept interpreted in various ways, with many researchers adopting the definition provided by Vidgen & Gallegos [3], which underscores functional abilities such as food planning and cooking. In Korea, there is an ongoing discourse about the definition of FL. Park *et al.* posit FL as the ability to manage dietary information for health promotion [4]. Yoo *et al.* [5] emphasize FL as more than just understanding nutritional information, including the capacity to manage one's diet and highlight the cultural, relational, and socio-ecological aspects of FL. Yoo *et al.* [5] categorized FL into 3 distinct domains. First, nutrition and safety FL focuses on acquiring and applying knowledge and skills related to nutrition and food safety. The second domain is cultural and relational FL, encompassing an interest in the cultural aspects of food and the ability to contribute to community life through food. The third domain is socio-ecological FL, which involves understanding and showing interest in the social and ecological consequences of individual food choices.

Building on Yoo *et al.*'s conceptualization of FL [2,5], a previous study conducted an in-depth analysis of the Seoul Food Survey, revealing that young adults, students, men, and people aged 18–29 are particularly vulnerable to low FL [6]. Among these groups, university students were notably a high-risk demographic. They were characterized by the lowest FL scores, with irregular diets, limited consumption of fresh foods such as fruits and vegetables, and heavy reliance on food from convenience stores or delivery services over home cooking [7]. Moreover, the Coronavirus Disease 2019 (COVID-19) pandemic further exacerbated this trend, increasing the consumption of Home Meal Replacements and delivery food among university students [8]. Because unhealthy eating habits during young adulthood can contribute to future weight problems and chronic diseases [9], improving FL to adopt healthier dietary habits is imperative.

Campus food environments play a pivotal role in shaping dietary behavior [10]. Changes in students' personal environments, such as shifts in living conditions, have altered dietary patterns, including meal frequency and opting for packaged and delivered foods [11,12]. Unfortunately, campus environments often provide limited access to healthy options and cooking opportunities [13]. Economic constraints are common among university students, making it challenging to make high-quality food choices [13]. Therefore, creating a campus environment conducive to healthy eating is crucial.

Notably, previous research revealed that students who received nutrition education in campus classes exhibited improvements in nutritional knowledge and dietary behavior [14]. Although post-intervention assessments revealed some decline in knowledge over time, they remained above the standard, emphasizing the importance of nutrition education in influencing students' dietary habits [15]. Malan *et al.* posit that FL plays a positive role in guiding and maintaining a healthy diet, making it a valuable nutritional education component [16]. Programs incorporating FL have demonstrated positive effects [17]. However, campus-based educational programs focusing on FL among university students are lacking.

Social Cognitive Theory (SCT) can be used for understanding human behaviors that posit the interaction of personal, behavioral, and environmental factors influencing physical and mental health habits [18,19]. Previous research explored the application of SCT on nutritional behavior and identified factors such as self-efficacy, social support, and self-regulation as key constructs associated with food purchasing and consumption [20]. In previous nutritional interventions utilizing SCT, improvements in behavioral skills and self-efficacy in the intervention group have been linked to increased fruit consumption [21]. Therefore, this study aimed to develop a campus-based education program for university students using key constructs from SCT, addressing the 3 domains of FL with the goal of promoting a healthy, happy, and sustainable diet, as defined in previous studies [2,5].

## Methods

### Ethics statement

This study was conducted with the approval of the Research Ethics Committee of Hallym University Institutional Review Board (HIRB-2021-009-3-RRRR). All the study participants provided written consent forms.

This study endeavors to develop a campus-based FL program tailored for university students. The research was conducted between January and June 2022, and the detailed steps are outlined in Fig. 1.

### Step 1: Analyzing existing FL programs and factors influencing FL among university students

To shape the program's components and measurement tools, we analyzed domestic and international literature encompassing existing FL-related intervention programs. This analysis enabled us to identify the necessity of the program. Additionally, we reviewed previous studies, including interviews with university students, to understand the facilitators and barriers affecting the FL of the individuals.

#### 1) Literature review

We conducted a literature search from January to March 2022 using PubMed and Google Scholar databases. The search focused on academic papers related to FL programs. Given the substantial growth in FL research over the past decade, we focused on literature published after 2014. Search keywords included "food literacy," "intervention," "program," "young adults," "youth," and "nutrition education." The inclusion criteria were educational programs or interventions targeting adults or young adults lasting at least 4 weeks, with pre- and post-measurements of FL concepts/areas during the intervention period.

Our search yielded 50 academic papers on adult FL intervention programs. After applying the inclusion criteria, 3 papers remained for analysis (Table 1). These studies ranged from 4 to 6 weeks and aimed to enhance various aspects of FL, such as

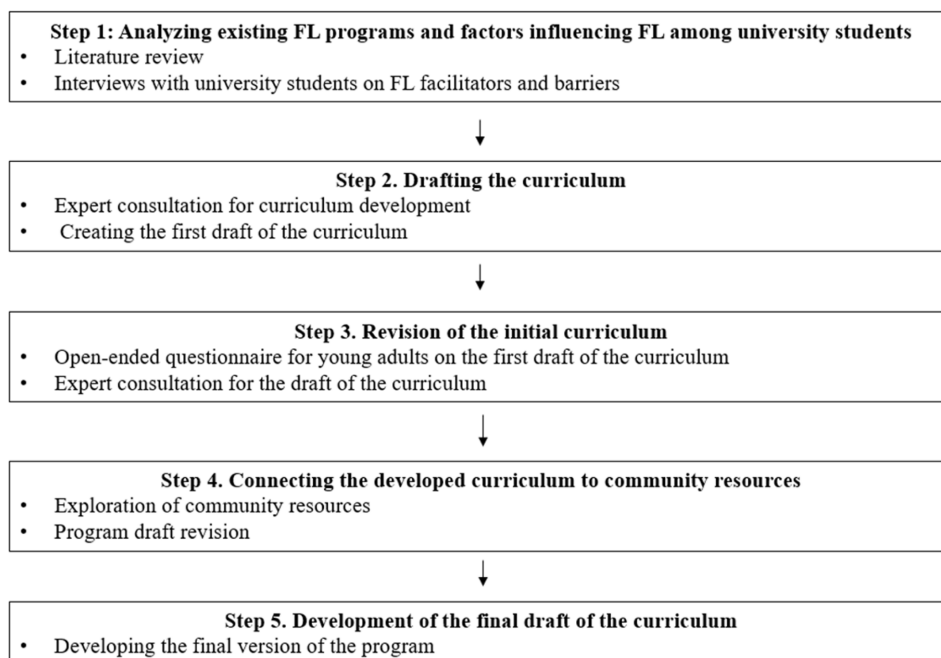


Fig. 1. Food literacy (FL) program development flowchart

**Table 1.** Literature review of food literacy intervention programs for adults

Authors	Year	Target group and sample size	Duration	FL areas	Evaluation tool	Outcome measures
Andrea Begley <i>et al.</i> [38]	2019	Low-to-middle income adults (n=1 092)	4 weeks	Planning and management, selection, preparation, cooking, and eating	- 14 items on FL behavior checklist - 4 short questions on dietary behaviors	- Increased FL behaviors and dietary intake positive behaviors - Increased planning and management, selection, preparation items - Increased fruit and vegetable intake - Increased food security, cooking confidence, food preparation behaviors, nutrition knowledge, vegetable consumption - Decreased intake of sugar-sweetened beverages, and salty snack foods
Elisha G. West <i>et al.</i> [39]	2020	Adults (n=21)	6 weeks	Promoting food security and FL	- 32 core questions on FL, food security and dietary intake - Qualitative semi-structured interviews	- Increased FL behaviors and improved dietary intake - Increased fruit and vegetable intake
Ng <i>et al.</i> [40]	2022	Adults (n=29)	4 weeks (online)	Increasing FL levels and vegetable consumption	- 11 items on FL - 2 items on fruit and vegetable consumption	- Increased FL behaviors and improved dietary intake - Increased fruit and vegetable intake

FL, food literacy

culinary planning, ingredient selection, food safety, and increasing vegetable intake. Although these studies demonstrated positive effects on improving FL-related behaviors, particularly fruit intake, and food-related techniques, FL intervention studies focusing on young adults were lacking. No studies targeted young adults and met the inclusion criteria.

## 2) Interviews with university students on FL facilitators and barriers

Between March and November 2020, we interviewed 25 university students aged 20 to 27 to identify the facilitators and barriers related to their dietary and FL [22]. Several key insights were used for the curriculum planning. For nutrition and safety FL, facilitators included diverse media channels for gaining nutrition knowledge and opportunities for culinary experiences. Barriers included financial constraints, lack of nutritional knowledge, irregular lifestyles, and academic stress. For cultural and relational FL, facilitators included exposure to foreign cultures and communal dining experiences, whereas the barriers included limited cooking experiences and eating alone. In terms of socio-ecological FL, facilitators encompassed previous experiences in cooking and gardening as well as personal preferences for taste and price advantages. Barriers included economic constraints, lack of knowledge, and limited opportunities for cooking.

Further details can be found in a previous study [22]. The interviews conducted in this study shed light on individual constraints and the restricted availability of resources within the campus setting, hindering efforts to enhance FL and cultivate a lifestyle of healthy dietary choices. Upon examining the participants' interview responses, the importance of a supportive campus environment and curriculum fostering opportunities to enhance nutritional knowledge, culinary skills, and a comprehensive understanding of various facets of FL was underscored.

## Step 2: Drafting the curriculum

### 1) Expert consultation for curriculum development

Building on insights from the literature review and interviews with university students, we sought expert feedback regarding the overall approach. A total of 5 experts participated, including professionals in food and nutrition, nutrition education, marketing, and service design.

Experts emphasized that while university students recognize the importance of a balanced diet, economic challenges and competing priorities often hinder their ability to practice it. They stressed the importance of creating an environment that makes healthy choices easy and promotes healthy eating behaviors. For young adults without health issues, offering positive experiences through practical activities was deemed more impactful than theory-based lectures. Furthermore, mindful eating was associated with high FL levels in young adults [7]. Given the correlation between the consumption of high-sugar and high-salt foods and stress-induced eating [7], the need for a program aimed at suggesting mindful eating has been emphasized. The research team was advised to align the curriculum with FL concepts and items, and a program evaluation was suggested using a survey questionnaire developed to measure FL levels in the Seoul Food Survey [5,23].

### 2) Creating the first draft of the curriculum

The initial draft of the FL program was based on insights from literature reviews, interviews with university students, and expert consultations. The educational curriculum was structured using 3 domains. In nutrition and safety FL, the program includes nutrition education using the Food Balance Wheel suggested by the Korea Dietary Reference Intakes [24] and information on the storage and utilization of ingredients. In cultural and relational FL, collaborative activities involved communal cooking and eating with classmates. The curriculum also incorporated cooking lessons to teach students how to make traditional Korean desserts, emphasizing their understanding of traditional Korean food culture. In the later part of the program, lectures and activities related to social and environmental themes were conducted, such as learning about fair trade and animal welfare under socio-ecological FL. Discussion sessions regarding policies and programs for enhancing food security among socially disadvantaged populations in the community were planned. Additionally, a key program activity involved students

directly observing and cultivating crops in the university's vegetable garden. The students experienced the growth of crops and tasted the produce firsthand, aiming to broaden their understanding of the 3 FL domains.

### Step 3: Revision of the initial curriculum

To enhance the program's acceptability among students, we distributed an open-ended questionnaire to young adults in April 2022 to assess the attractiveness and suitability of the curriculum. Expert input was sought for further curriculum refinement.

#### 1) Open-ended questionnaire for young adults on the first draft of the curriculum

In April 2022, we provided the draft of the curriculum and an accompanying open-ended questionnaire via email to 16 young adults of both genders, aged 20 to 24. The questionnaire inquired about their interest in the program, suggestions for improvement, desired activities, activities they did not wish to engage in, and the reasons for them. The participants were also asked if they had additional questions about the program. All 16 students responded, and it was confirmed that they were divided into a group of interested and uninterested students. Both groups responded that student participation will only increase when activities directly benefit students or apply to their daily lives.

#### 2) Expert consultation for the draft of the curriculum

Expert consultations were conducted after collecting feedback on the program draft from the young adults. This meeting involved 1 expert with extensive experience in nutrition education and 1 expert in service design. The experts advised on additional elements that could be added to the curriculum and modifications to the draft.

Based on the young adults' feedback and expert input, the program was revised into a 3-credit course that could be offered within the Department of Food Science and Nutrition. Furthermore, feedback from the initial draft indicated the content related to the socio-ecological domain of FL lacked practicality. In response to this feedback, the items within this domain were revised to focus on practical topics, such as animal welfare and veganism, allowing students to learn in a more applicable manner. The expert consultations played a pivotal role in refining and improving the program prototype.

### Step 4: Connecting the developed curriculum to community resources

To determine the locations and instructors of the program, we explored campus and community resources. Lecture rooms and kitchen facilities in the Department of Food and Nutrition on campus were selected first to facilitate access to the program by university students. The research team also searched for local farms within the city where the university was located and explored opportunities for activities that may be challenging to conduct on campus. For instructors, we recruited nutrition professionals, local food producers, yoga instructors, and local vegetarian and environmental activists. To implement the curriculum, 7 instructors from the city were contacted. In terms of location, 3 venues were selected, with preference given to campus facilities for cost and sustainability.

### Step 5: Development of the final draft of the curriculum

Based on SCT principles, the education program was designed to enhance FL by incorporating FL elements derived from previous research [5]. This comprehensive FL program was finalized, offering an integrated learning experience combining theory and practice over 11 weeks.

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## Contents

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The finalized curriculum draft is rooted in the theoretical framework of SCT and is designed to cover 3 main FL domains: nutrition and safety, cultural and relational, and socio-ecological aspects.

### FL domains: Foundations of the curriculum

The content of the program was thoughtfully structured to correspond with the distinct FL domains. First, regarding the nutrition and safety of FL, the participants were guided to acquire essential knowledge and skills related to food ingredient preparation and storage. They were provided with hands-on opportunities to prepare local dishes to impart fundamental culinary competencies and dispel misconceptions regarding the perceived complexity of cooking. Moreover, these cooking experiences were designed to be shared, fostering communal bonds among the participants, which are linked to the relational aspects of FL.

Second, regarding the cultural and relational aspects of FL, the students were immersed in creating traditional Korean desserts, thereby deepening their appreciation of the intersection of food and culture. Participants are not only introduced to the historical significance of these traditional desserts but are also taught the intricate art of their preparation. Additionally, students have the unique opportunity to share their culinary creations with friends. Finally, for socio-ecological FL, a series of instructive classes on topics included vegetarianism, animal welfare, and zero-waste practices. The classes were taught by experts in each field and offered comprehensive insights into the ecological aspects of personal food choices. Participants are expected to be equipped with the knowledge to understand these critical social issues, empowering them to contemplate practical strategies to pursue harmonious coexistence with the Earth.

In addition to the core concepts of FL, the program also covered mindful eating practices among young adults. Therefore, yoga classes and mindful eating practices were incorporated into the curriculum. In summary, the 11-week FL program was developed by incorporating all 3 core FL domains and the stress management aspects of campus life.

### Curriculum development according to SCT

The curriculum was developed based on the core elements of SCT. To enhance self-efficacy, a basic cooking program was added at the beginning of the program. Utilizing campus kitchens made it possible to enhance environmental factors and promote interpersonal aspects through cooking together and sharing meals. Team activities and team building were included to improve observational learning and social support, which had been dramatically reduced on campus because of social distancing due to COVID-19. Prior to the start of the program, senior student tutors in the Department of Food Science and Nutrition were recruited and trained. This ensured smooth program progress and fostered peer bonds. Finally, all classes incorporated behavioral factors, allowing for the parallel application of theory and practice.

### 11-week program curriculum

The 11-week program, detailed in Table 2, commences with an orientation in Week 1, in which participants are introduced to FL and mindful eating. In Week 2, the groups are divided: one attends yoga sessions, while the other learns food storage and preparation techniques, including making dishes such as Dakgalbi and oil Tteokbokki. Week 3 involves an emotional awareness class alongside starting a mindful eating diary, which students update 2-3 times weekly to reflect on the emotions associated with their meals. In Week 4, the teams exchange activities from Week 2. Week 5 features the topic of veganism led by an expert from Chuncheon. This expert educates the students about veganism and daily vegan foods and guides them in preparing and tasting vegan finger foods. Week 6 sees the students visiting a local farm for produce harvesting and cooking, coupled with group games and team-building exercises. Week 7 includes a class led by an animal protection expert discussing the definition, importance, and contemporary status of animal welfare, focusing on its practical applications from the perspective of university students. During Weeks 8 and 9, the focus shifts to making traditional Korean desserts in campus kitchens. In week 10, participants will delve into the concepts of zero-waste and circular economy, engaging in practical activities such as crafting plastic-free shampoo bars. The program culminates in Week 11 with a completion ceremony, providing a platform for participants to reflect on and share their experiences.



**Table 2.** Final version of the curriculum for improving food literacy among university students

Week <sup>1)</sup>	Topic	FL components <sup>2)</sup>	Time	Contents	Main in-class activities	Location/ instructor
Week 1	Mindful eating-based FL program orientation	-	90 min	- Gaining an understanding of the overall direction of the FL program - Learning about the concept of mindful eating - Learning about the concept of FL - Form teams with 5-6 members per team	- Group ice breaking	- Lecture room - Program facilitator
Week 2	Mindfulness, health consciousness	Mindful eating	2 h	- Recognizing and reflecting on emotions and mental well-being - Each group can share their emotions before and after yoga	- Yoga session	- Yoga studio - Yoga instructor in the community
Week 3	Personalized food diary with self-emotion awareness	Mindful eating	3 h	- Definition and functions of emotions - Types of emotions (positive and negative) - Dealing with emotions and stress	- Writing food diaries - Understanding my emotional patterns	- Lecture room - Counselor on campus - Campus kitchen
Week 4	Food ingredient storage, how do you do it?	NS	3 h	- Learning about food ingredient preparation - Learning about food storage methods - Types of local foods in Chunchcheon	- Making Dakgalbi - Making <i>al Tteokbokki</i>	- Professor from Department of Food Science and Nutrition - Lecture room and Campus kitchen - Local vegetarianism activist
Week 5	Vegetarianism? Yes, vegetarianism!	SE	3 h	- Environmental issues and veganism (domestic and international cases) - Classification of vegetarianism - Reasons for vegetarianism - Practices of veganism - Finding vegan products - Vegetarianism quiz	- Making vegan cakes with fruit - Vegan cheese Canapés (finger foods)	- Lecture room and Campus kitchen - Local vegetarianism activist
Week 6	Field trip to a local farm	All	1 day	- Experiencing local farm (harvesting crops and cooking in traditional ways) - Take time to heal in nature - Group bonding exercises	- Harvesting produce (radish) - Making Tofu and Injeolmi - University students creating group videos related to healing	- Local farm village - Local food producers and program facilitator - Lecture room
Week 7	Animal welfare	SE	3 h	- What is animal welfare? - The impact of factory farming on chickens and pigs - The importance of animal welfare - The current state of animal welfare	- Group discussion: What is animal welfare that university students can practice? - What is animal welfare that university students can practice?	- Animal protection group expert and program facilitator
Week 8-9	Making traditional Korean dessert	CR	3 h	- Types of snacks enjoyed by Korean ancestors - Cooking methods for snacks enjoyed by past Korean ancestors - How to package the desserts as a present	- Making Gae-seong-juk - Making <i>Mo-yakgwara</i>	- Campus kitchen - Professor from Department of Food Science and Nutrition - Lecture room
Week 10	Practicing zero-waste	SE	3 h	- What is zero-waste? - Circular economy, an explanation - The importance of zero-waste	- Making shampoo bars - Group discussion: What can I practice for zero-waste?	- Environmental activists - Lecture room
Week 11	Completion ceremony	All	90 min	- Reflecting on activities from week 1 to 10 - Wrapping up the course	- Group sharing of lessons learned throughout the course	- Lecture room - Program facilitator

1) The class is divided into 2 groups for weeks 2, 4, 8, and 9.

2) FL, food literacy; All, nutrition and safety FL + cultural and relational FL + socio-ecological FL; NS, nutrition and safety FL; CR, cultural and relational FL; SE, socio-ecological FL



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### Curriculum evaluation and organization

The program is structured around 15 measurement items for FL, comprising 2 items each on self-efficacy and knowledge, 9 on attitudes, and 2 on behavioral skills. Although environmental constructs were not included in the measurement tools for the program evaluation, we attempted to incorporate some environmental elements from SCT into the program (Table 3).

These items were used for program evaluation. The program ran for 3 h, including 90 min of theory-based lectures and 90 minutes of practical sessions. The duration of the lectures and practice sessions varied depending on the weekly topic. The program began with nutrition and safety FL and mindful eating classes and gradually expanded to socio-ecological FL. All practical sessions of the program primarily consisted of group activities and a certain amount of time was allocated each week to share stories among the participants. Additional supplementary components can be added to the curriculum as the program progresses after evaluating the level of participation and understanding of the participants.

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## Evaluation

During program development, potential target participants provided feedback after reviewing the initial draft of the curriculum. This feedback focused on their interests, areas for improvement, preferred activities, and activities they did not want to participate in. Young adults were divided into 2 groups when asked about their general interest in the program. We summarized their main feedback based on their general interest for the following 2 reasons: 1) to understand whether there is any key difference in their feedback according to their interest and 2) to find strategies to attract more participants, especially those who were not initially interested in the program. The main ideas are summarized below.

### Interested group

When considering the difficulty of living among young adults, especially in preparing ingredients or the lack of a conducive environment for cooking activities, the program was found to play a positive role. Conversely, some young adults felt that activities such as cultivating a vegetable garden, which falls under socio-ecological FL, were impractical and did not perceive the necessity of such activities. Even within this interested group, opinions varied regarding the frequency and duration of the program sessions. While some found the program content interesting, others felt it might become burdensome because of time constraints during the semester. Suggestions included integrating this program into extracurricular activities for students majoring in food and nutrition.

### Uninterested group

Participants in this group indicated a willingness to participate if accompanied by close friends but found it challenging to engage alone. Furthermore, the participants stressed the importance of gaining benefits from the program, such as recognizing volunteer hours or academic credit, to incentivize participation. They also felt that participants not majoring in food and nutrition might find investing time in the program burdensome.

### Expert consultation

The experts provided detailed advice on the program. Experts suggested that, while the program content appears interesting, students might find it burdensome to participate weekly, considering other academic requirements. They emphasized the need for breaks between sessions. Because program participation cannot be compulsory, they emphasized the importance of providing motivation and adding fun activities in which participants were genuinely interested. They also suggested aligning the program with the students' recent interest in fostering empathy and enhancing participation. The experts recommended guiding students during the program to help them assess their progress, learn, and identify areas of improvement. Finally, they highlighted the importance of team activities in fostering friendships and underscored the significance of peer tutor roles.

**Table 3.** Key food literacy and social cognitive theory domains and sub-elements for program development

SCT domains <sup>1)</sup>	FL domains	Nutrition and safety FL	Cultural and relational FL	Socio-ecological FL
Cognition factor	Self-efficacy	<p><b>Culinary skills</b></p> <ul style="list-style-type: none"> <li>- I can follow a simple recipe.</li> <li>- I can prepare a meal without difficulty.</li> </ul>		
	Knowledge	<p><b>Food management</b></p> <ul style="list-style-type: none"> <li>- I know how to separate and store ingredients that cannot be consumed immediately.</li> </ul>		<p><b>Ethical purchase</b></p> <ul style="list-style-type: none"> <li>- I know the reasons why animal welfare can be important in purchasing meat and eggs.</li> </ul>
Behavioral factor	Attitudes		<p><b>Process of dining</b></p> <ul style="list-style-type: none"> <li>- I enjoy cooking.</li> <li>- I am grateful for the process that has allowed the food to come to the table.</li> </ul> <p><b>Interpersonal relationships</b></p> <ul style="list-style-type: none"> <li>- I like to share food with my family, friends, and neighbors.</li> <li>- I enjoy talking about food with people around me.</li> </ul> <p><b>Interest in traditional cuisine</b></p> <ul style="list-style-type: none"> <li>- I enjoy traditional food, which can help protect our cultural identity.</li> </ul>	<p><b>Interest in sustainable eating</b></p> <ul style="list-style-type: none"> <li>- I think farming and farmers are important for a sustainable society.</li> <li>- I believe that reducing meat and promoting vegetarianism helps slow climate change.</li> <li>- I am interested in urban agriculture (such as city gardening, weekend farming, etc.).</li> </ul> <p><b>Thinking a food equality</b></p> <ul style="list-style-type: none"> <li>- I think everyone should have access to quality food regardless of economic circumstances.</li> </ul>
Environmental factor <sup>2)</sup>	Behavioral skills	<p><b>Hand washing</b></p> <ul style="list-style-type: none"> <li>- I wash hands thoroughly before cooking.</li> </ul>	<p><b>Interest in waste reduction</b></p> <ul style="list-style-type: none"> <li>- I try to reduce food waste and food packaging waste (take-out drinks, delivery foods, etc.).</li> </ul>	
		<ul style="list-style-type: none"> <li>- Establishing opportunities for observational learning through tutor-tutee activities</li> <li>- Inviting relevant professionals to acquire social norms such as zero-waste and animal welfare</li> <li>- Establishing opportunities for social support through tutor-tutee activities</li> <li>- Creating an environment for cooking opportunities through opening campus kitchen facility</li> </ul>		

1) SCT; social cognitive theory

2) Although environmental constructs were not included in the measurement tools for program evaluation, we tried to incorporate some environmental elements from SCT into the program.



Fig. 2. Food literacy (FL) program overview

Comments from the young adults and experts were incorporated into the revised version of the curriculum (Fig. 2). The completed program was implemented from August 2022 to February 2023. The results and effectiveness evaluations are detailed in a separate paper.

## Implications

Nutrition education for young adults plays a pivotal role in preventing chronic diseases and cultivating a healthier society. While the significance of FL education is steadily gaining recognition [25], the development and implementation of FL programs are still in the nascent stages. Although finding nutritional education and dietary programs grounded in FL remains challenging, interventions specifically tailored for young adults have been designed and implemented. For instance, Joung *et al.* [26] devised a dietary life program tailored to young adults living in single-person households, yielding notable enhancements in temperance and daily life, as indicated by improvements in the adult Nutrition Quotient index. Ghammachi *et al.* [27] successfully conducted a web-based nutrition education program employing Social Network Services, resulting in heightened awareness and knowledge levels pertinent to sustainable diets among young adults. Given the efficacy of nutrition education for young adults, it is reasonable to anticipate that this program will help improve their eating habits.

The program was meticulously designed to provide nutrition education in a university campus setting. Universities are acknowledged as pivotal environments that significantly impact students' health [28]. A study investigating dietary education preferences among young adults in single-person households affirmed that university students favor face-to-face education and prefer nutrition education in the university context [29]. Furthermore, participation in on-campus nutrition education led to improvements in nutritional knowledge and eating attitudes [30]. Given that university students primarily conduct their daily lives on campus, the seamless integration of nutrition programs into their routines is paramount in facilitating knowledge

enhancement and attitudes changes.

This program was underpinned by a tutoring-based approach to nutrition education. This pedagogical method has effectively fostered friendships and addressed social and self-esteem needs [31]. Tutoring initiatives with nursing students have revealed enhancements in problem-solving abilities, critical thinking skills, improved communication, and individual growth [32]. Similarly, in a study focused on health promotion programs for children utilizing peer tutoring, health-related knowledge scores substantially improved for tutors and tutees [33]. Through the development of this nutrition program, tutoring emerges as a mechanism for university adaptation and learning, offering opportunities for lower-grade students to become tutees. This, in turn, is expected to yield positive outcomes such as heightened confidence and personal growth for tutors and tutees.

The program incorporates activities involving community experts and instructors, offering opportunities for students to engage with local resources firsthand. Students learning from community experts tend to exhibit favorable shifts in their attitudes and increase their confidence [34]. Moreover, it extends beyond the traditional educational role of universities by embracing a broader community engagement facet [35]. This facilitates the expansion of community services related to education [36]. Consequently, the program is structured to deliver mutual benefits to the community and participating students.

This program has been designed in alignment with the SCT. Similarly, McWhorter *et al.* applied SCT to develop a program aimed at promoting behavioral change, recipe demonstration, and enhancement of healthy food consumption behaviors to augment FL, culinary skills, and knowledge of nutritionists, ultimately confirming improvements in nutritional proficiency [37]. However, the socio-ecological domain was not encompassed within the scope of FL in that study. In contrast, the program presented herein comprehensively covers various FL domains. As such, it is anticipated that an 11-week curriculum will positively influence nutrition and environment-related competencies, surpassing the achievements of prior studies in this regard.

This study developed an 11-week campus-based program targeting university students using FL and emotional factors. However, this study did not include an evaluation process for the effectiveness of the developed program, making it difficult to assess its validity. A separate manuscript on the effectiveness evaluation is underway, which can be informative in providing future directions for the program.

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## Conclusions

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This study successfully crafted an 11-week FL program harnessing the resources available within the campus and the broader community. By integrating theoretical and practical classes, the program was designed to augment students' comprehension and interest in FL. The significance of this study lies in its provision of foundational data that can inform the development of forthcoming FL initiatives. Future research should prioritize assessing the program's effectiveness through direct implementation and evaluating its suitability as a nutrition education program tailored to young adults. Moreover, there is a pressing need to delve into the elements and tools essential for sustaining continuous education rather than limiting interventions to one-time occurrences. Consequently, this study provides invaluable insights into the design and execution of future FL programs targeting university students.

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## Conflict of interest

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The authors declare that they have no potential conflicts of interest.

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## Data availability

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The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

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