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Enhancing Student Behavior with the Learner-Centered Approach in Sustainable Hospitality Education

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Abstract: This study aims to implement the concept of education for sustainable development by 2030, which can be applied in the context of hospitality education in the Asia–Pacific region. Specifically, this study focuses on achieving Sustainable Development Goal 12, which pertains to responsible consumption and production, particularly in relation to food. A case study was conducted using a learner-centered approach, wherein students, as active agents, can solve problems using professional skills such as cooking, baking, and beverage preparation. Through participant observations, students learn about sustainability, starting from natural farming and extending to banquet planning and entrepreneurship simulation in a green restaurant. The program was designed as a farm-to-table process for sustainability learning. A conceptual framework of a hospitality–health supply chain was constructed to understand how the program supports the goal of education for sustainable development for 2030—societal transformation. The study has several important implications. Students are trained to be responsible producers in a green dining setting, starting from practical classroom experiences in the kitchen of a green restaurant, which will enhance their becoming the critical human resources in the hospitality industry. This program offers a successful vocational education opportunity, teaching students how to responsibly run an enterprise with low-carbon products and services.



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1. Introduction

Food not only connects with people’s lives, but it is also strongly linked to human health [1] and environmental sustainability [2]. Critical evidence from the Sustainable Development Goals (SDGs) Report 2023: Special Edition [3] emphasizes the importance of this perspective. The report highlights the significance of SDG 2, zero hunger, as it reveals that “an estimated 29.6 percent of the global population—2.4 billion people—were moderately or severely food insecure, meaning they did not have access to adequate food”. Food insecurity [4] is a psychological process where individuals perceive insufficient dietary intake, leading to increased feelings of pressure.

Ironically, while some people lack food, others waste it [5]. Balancing SDGs 2 and 3 around the provision and utilization of food, therefore, becomes difficult. SDG 12, responsible consumption and production, attempts to address the issue of food waste, stating that “the world is also seriously off track in its efforts to halve per capita food waste and losses by 2030”. This has met the green competence [6]. This presents a critical challenge for educators, prompting them to reconfigure environmental sustainability education by

connecting the problems of hunger and food waste. The teaching strategy should aim to instill empathy in students [7]. In this context, empathy is the ability to imagine someone being hungry even when you have enough food, and to reflect on how one's actions can improve food waste behaviors and promote human health [8]. Therefore, the backdrop for this discussion is the importance of SDG 12 as a necessary component of ESD for the 2030 agenda [9].

The ESD for 2030 agenda, abbreviated as ESD for 2030, was proposed by the United Nations Educational, Scientific and Cultural Organization (UNESCO). It aims to implement a global sustainability framework from 2020 to 2030. In 2022, UNESCO announced a roadmap for ESD for 2030 [10] to guide the future of sustainable education for everyone. The roadmap highlights the importance of the following: "ESD empowers learners with knowledge, skills, values, and attitudes to make informed decisions and take responsible actions for environmental integrity, economic viability, and a just society, empowering people of all genders for present and future generations while respecting cultural diversity" [10] p. 8.

Implementing ESD for 2030 has become a significant challenge in various educational fields because sustainable education is not a single concept but rather an interdisciplinary body of knowledge. For instance, food is interconnected with various issues, ranging from physical hunger to mental health to the conditions of agricultural production, such as farm size and land yields [11]. Culinary delicacies comprise diverse foods and beverages, representing a farm-to-table process where food materials pass through a lengthy and complex agri-food supply chain [12,13] before reaching end customers. In the farming stage, agriculture should be carried out using organic or natural approaches to protect both land and human health. In this paper, we did not specifically define the difference between organic and natural; however, we care about the right way for people's health and environment. Therefore, during food processing, care must be taken to avoid the use of illegal food additives. The preparation of diverse foods from different corners of the world contributes to the development of the global food culture [14], exemplified by such dishes as kimchi in Korea, sushi in Japan, and fried stinky tofu in Shengkeng Old Street, Taiwan.

However, integrating the concept of sustainability into various sciences is not an easy task within environmental sustainability education [6]. For example, eco-innovation [15] combines ecological and innovative approaches to sustainability, often requiring collaboration between technology and engineering disciplines. However, food in the context of hospitality education has emerged as a prominent topic [16]. This is primarily because hospitality education, or hospitality management education [17], typically emphasizes practical skills, such as Chinese cuisine, Western cuisine, baking, beverage preparation, or drink mixing techniques. In the culinary environment, whether in a kitchen or at a bar counter, where gastronomy is exercised by chefs or bartenders, a variety of food and beverage materials is utilized daily. These materials are combined to create agri-food products [18]. Each agri-food product is intended to be served through various services, such as restaurant service in Michelin-starred restaurants or beverage (coffee) service in Starbucks chain stores. This illustrates the presence of an agri-food supply chain [12,13] that permeates the quality of human life [19] and enhances product brand competitiveness [20].

In light of the aforementioned theoretical and industrial needs, we understand that food plays a specific role in promoting corporate social responsibility (CSR) within the context of food products, and subsequently, hospitality education transforms food into a university social responsibility (USR). This represents a meaningful objective, as this study seeks to explore the concept of ESD for 2030 with an effective teaching strategy [21] that can be applied to sustainable hospitality education [22]. Therefore, the primary aim of this study was to investigate sustainable hospitality education and establish a sustainable hospitality supply chain management [23] in a practical case.

2. Literature Review

This study considered the entire sustainable hospitality supply chain from farm to table. The Department of Hospitality Management at Meiho University is implementing SDG 12 by examining how responsible consumption and production can be trained in the sustainable hospitality supply chain. In this case, the green restaurant is the center of the sustainable hospitality supply chain, which is also called the sustainable restaurant. This restaurant is used to connect the upstream and downstream segments of the hospitality supply chain. The upstream segment is organic or natural farming for agriculture, and food and agriculture education are incorporated. Students work as farmers to build a sense of gratitude, for example. The concept of entrepreneurship education is also used in the green restaurant. Students function as owners and learn how to provide responsible services and products for customers. Customers can then participate and learn about responsible consumption. Therefore, the ultimate goal is to achieve ESD for 2030—societal transformation by fostering responsible behavior and attitudes among students.

2.1. Sustainable Hospitality Education: Integrating Sustainability Learning

Sustainable hospitality education aims to incorporate sustainability learning into the foundation of hospitality education. Sustainability learning [24] encompasses the application of environmental education across various educational levels, from kindergarten to higher education. Some sustainability learning topics are closely related to climate change [25], which is a result of CO₂ emissions [26] stemming from manufacturing processes, energy consumption, and transportation. As a result, the carbon footprint [27] serves as an indicator that assesses the extent of CO₂ emissions from the source to the marketplace. For instance, when food materials are imported from another country, their carbon footprint is typically higher than that of locally sourced materials. This is because imported materials require various modes of transportation, such as air, sea, or land, leading to increased carbon emissions.

This highlights the impact of food logistics on the carbon footprint. However, the scope of sustainability learning is not confined to a single topic such as CO₂ emissions; it also encompasses all SDGs and other critical issues, such as cultural considerations in the hospitality workplace [28], within the field of sustainability science [29].

When sustainability science is associated with the SDGs, it underscores the increasing importance of education for sustainable development (ESD). As is well-known, sustainable transportation [30] aligns with sustainable transportation education [31], sustainable architecture [32] transitions into green architecture education [33], and even sustainable tourism [34] encompasses sustainable tourism education [35]. However, it is important to note that each SDG is not confined to a single educational field but often intersects with various disciplines. For example, when addressing SDG 12, responsible consumption and production, which focuses on issues within the farm-to-table process, particularly related to food waste and loss, sustainability learning spans from the upstream to the downstream segments of the agri-food supply chain [12,13]. Sustainable education can be broadly divided into agricultural farming, agri-food production and processing, and final preparation in restaurants or beverage production in coffee shops. Therefore, sustainability learning encompasses the entire ecosystem [36], ranging from eco-farming education [37] to sustainable hospitality education [22].

As mentioned earlier, each of the SDGs intersects with various aspects of sustainable education and sustainable hospitality knowledge concurrently. This is because sustainable hospitality supply chain management [23] reflects the complexity of the hospitality industry, which aims to provide high-quality products and services to both international and domestic customers. The hospitality industry encompasses a variety of stakeholders,

including restaurants, accommodations, transportation, conventions and meetings, amusement parks, and shopping malls. All of these stakeholders can contribute to sustainable business practices, such as green restaurants [38], green transportation [39], and green meetings [40]. These green practices are increasingly encouraged to align with the International Organization for Standardization (ISO) environmental management system [41] as part of CSR.

In recent years, TM et al. [38] have highlighted that green restaurants have become the focus of research agendas. Green restaurants not only address food waste, but also emphasize responsible consumption. This implies that green restaurants involve responsible behavior both in food production by restaurant workers and food consumption by customers. This aligns with the goals of SDG 12, responsible consumption and production. Consequently, sustainable hospitality education integrates both the supply and demand sides of green restaurants into sustainability learning. On the supply side, the kitchen aims to provide cuisine that reflects local cultural diversity. Its teaching subject focuses on how to source local and fresh food materials in season, with an emphasis on reducing energy consumption and minimizing food waste during the cooking, baking, and beverage preparation processes. On the demand side, green restaurants aim to provide environmentally friendly services to customers. This includes guiding customers not to use disposable tableware [42] and encouraging them to visit green restaurants frequently as a way to support environmentally friendly practices [43].

To synthesize the key points mentioned earlier regarding theory and industry, a critical question arises in sustainable hospitality education: how to enhance teaching and learning motivation within the context of situated learning. There still exists a gap between the hospitality industry and higher education in terms of transferring domain knowledge from the hospitality industry to the classroom. In this regard, a green restaurant serves as a suitable hands-on, learning-by-doing approach [44] when there is a need for sustainable hospitality education.

2.2. *Fostering a Learner-Centered Approach in Sustainable Hospitality Education*

In the realm of sustainable hospitality education, it is imperative to consider the “learning-by-doing” method as an effective teaching strategy [21]. The rationale behind this lies in the fact that traditional teaching methods no longer adequately address the learning needs of today’s students. The “learning-by-doing” approach shifts the teacher’s role from being the center of learning to that of a guide. This implies that students themselves become the focal point of learning, marking the essence of learner-centered education [45]. Learner-centered education promotes active learning, wherein students are tasked with finding answers to questions and constructing knowledge through self-directed learning [46]. According to Norman and Spohrer [45], the teacher’s role in learner-centered education is to encourage students, fostering an environment where “students are perceived as active participants in the learning process and co-constructors of knowledge”.

Bremner and Cameron [47] introduced another term in learner-centered pedagogy. Their study documented the positive outcomes associated with the implementation of learner-centered approaches. Based on these positive outcomes, the learner-centered approach has influenced the role of the teacher, shifting teachers from functioning as merely activity organizers [48] to guides and motivators, providing authoritative feedback and fostering responsible behavior.

With regard to the teacher’s role as an activity organizer, the learner-centered approach proves to be an effective teaching strategy in sustainability learning. For instance, Herranen et al. [49] conducted a case study in Finland where learner-centered/learner-driven pedagogy was implemented. In this approach, five students were encouraged to act as

course designers for sustainable development knowledge. The learning process allowed learners to experience freedom, meaningfulness, active participation, and the ability to make an impact in environmental education. Another example is a case study presented by Galt et al. [50], which focused on a food systems course at the University of California. Qualitative research methods were employed to collect and analyze students' learning experiences within learner-centered inquiries. Through reflective essays, the study examined the evidence of how student-centered inquiries had a significant transformative impact on students' life experiences. The study guided students in their inquiries related to everyday places such as supermarkets. Based on their experiences in the field, students were able to deliberate on how and why they engage in commodity fetishism, which involves critical thinking and reflection processes.

The learner-centered approach has increasingly been linked to learner-driven strategies [49], and collaborative learning theory has also been incorporated simultaneously. For example, Zhou et al. [51] presented a case study conducted in a computer concept course in China. This study employed a combination of qualitative and quantitative research methods. An interesting aspect of their study was its focus on gender differences. The study revealed that male students tended to have more positive perceptions of collaborative learning compared to female students. This highlights the need to provide guidance and support for students of different genders in terms of teamwork. Therefore, with self-discipline, students can actively engage in learning and enhance their teamwork skills, contributing to their sustainability competence. Sustainability competence requires students to prepare reports and presentations that demonstrate their proficiency in computers and multimedia to showcase their understanding of sustainability knowledge and how they have applied it.

Meanwhile, the ESD for 2030 roadmap provides an important guideline, stating "pedagogy and learning environment: employ interactive, project-based, learner-centered pedagogy. Transform all aspects of the learning environment through a whole institution approach to ESD to enable learners to live what they learn and learn what they live" (UNESCO) [10] p. 8. For the reasons mentioned above, the learner-centered approach is well-suited to be adopted in conjunction with interactive, project-based, problem-based, and cooperative learning content in sustainable hospitality education. This approach, particularly, can be extended to achieve the objective of enabling learners to live what they learn and learn what they live.

3. Materials and Methods

3.1. Rationale for Using the Case Study Methodology

In this study, the case study methodology was employed. Case studies are valuable tools for exploring the underlying reasons and mechanisms behind societal inquiries and phenomena [52]. They enable the examination of previously unknown phenomena. In the field of education, case studies have also been utilized in teaching educational psychology [53]. The realm of psychology delves into personal authenticity, encompassing outward behaviors and inner feelings. Although it may be challenging to dissect how personal behavior translates into intrinsic thinking, attitudes can be considered as valuable evidence. For instance, Chen and Wu [22] proposed a case study to comprehend the dynamics of food waste in sustainable hospitality education. While food waste stems from individual behavior, understanding the rationale behind such behavior provides insights into the motivations that drive personal actions.

To gain insights into the underlying factors within the societal-cultural context and how ESD for 2030 can be implemented in sustainable hospitality education to address food waste and loss, the case study methodology was adopted to examine a specific case in Taiwan within the Asia-Pacific context. Several compelling reasons support the use

of the case study approach. It allows for a deeper understanding of the significance of reflections in teacher education [54], the construction of the concept of the agri-food supply chain [12,13] within a societal-cultural context, and the pursuit of SDGs in sustainable hospitality education when dealing with unfamiliar situations [55]. Therefore, the concept of sustainable hospitality supply chain management [23] provides a framework for examining the proposed case study and understanding how to achieve the goal of ESD for 2030 —societal transformation, while fostering responsible behavior and attitudes among students.

The proposed reasons have supported and outlined the specific situation that warrants exploration in the case study of Meiho University, located in southern Taiwan. Why was Meiho University chosen as the subject of examination? The primary reason is that the university has been involved in a long-term project focused on executive USR and a teaching practice research program. These initiatives have received support from Taiwan's Ministry of Education (MOE) since 2015 and continue to the present day. While most USR projects are related to SDGs, there has been no prior learning activity connected to the topic of food waste and loss. Therefore, the Department of Hospitality Management at Meiho University is dedicated and purposeful in its efforts to implement SDG 12, addressing responsible consumption and production in various aspects of green living, including green catering, green accommodation, sustainable tourism, and, notably, green restaurants.

3.2. Data Collection for Sustainability Learning

The participant observation approach [56] was employed to gather qualitative data in the case study conducted from January to December of 2023. The primary participants in this study were students from the Department of Hospitality Management at Meiho University. Specifically, there were 32 fourth-grade students in the five-year junior college program, consisting of 27 women and 5 men. The program was designed based on the principles of sustainable hospitality supply chain management [23]. Within this framework, the curriculum included subjects related to food and agriculture education for responsible production in the supply aspect. Additionally, in collaboration with an internship restaurant (referred to as the green restaurant) within the Department of Hospitality Management, the program incorporated banquet planning for both responsible production (ensuring delicious food) and responsible consumption (customer visits). All 32 students participated in various learning activities, including natural farming and the organization of a welcome banquet.

The green restaurant was prepared for the learning activity, starting from the supplier (the farmer) to the receiver (the restaurant owner or food provider). This was essential because the green restaurant aimed to offer low-carbon agri-food and services to its customers, thereby encouraging responsible consumption within the business environment.

The scope of data collection encompassed the entire sustainable hospitality supply chain. Data on students' learning experiences and interactions were collected from both the supply side and the demand side of the green restaurant. On the supply side, students took on the roles of farmers, chefs, and waiters, all with the aim of being responsible food producers. The responsible farmer students used ecological approaches to cultivate vegetables, which served as food materials for cooking in the green restaurant. The responsible chef students were responsible for cooking, baking, and preparing beverages with low-carbon practices to create delicious food. Lastly, the responsible wait staff students provided non-disposable tableware for customers.

On the demand side, there were two banquets hosted by the green restaurant. The first was a welcome banquet held for very important persons (VIPs) on 31 October 2023. There were a total of 13 VIPs in attendance. The gender distribution among these VIPs

was as follows: 6 men and 7 women. The second banquet was an entrepreneurship simulation event held for 220 students and faculty members from Meiho University and other departments. This event took place on 20 and 21 December 2023.

As the researcher also serves as the director of the Department of Hospitality Management, the responsibility for overseeing the entire process fell upon the researcher. Consequently, the learning activities, spanning from the farm to the table, were designed and actively participated in by the researcher. Data collection was carried out through semi-structured questionnaires administered during face-to-face interviews. These interviews were conducted both before and after the sustainability learning activities. Before the learning activities, the focus was on assessing students' preparedness, including their knowledge of actions for food conservation, among other factors. Following the learning activities, the interviews aimed to understand their actions and reflections during the teamwork process. Given the participation of over 200 customers, only 13 VIPs engaged in conversations to gain insight into how they learned about the green restaurant. Questions included items such as "Were you aware that the tableware, food materials, table service, and menu were designed with environmentally friendly considerations?"

Voice data from the interviews were recorded and stored, while other direct data sources included field notes, observational photographs, and videos captured during students' learning activities. Additionally, indirect data sources, such as students' reflective reports and PowerPoint presentations, were collected and reviewed to identify any issues. If discrepancies were evident, they were confirmed with the students themselves. Therefore, the collected data were initially considered as raw data. After conducting preliminary checks, the raw data were filtered and cleaned based on various characteristics and sources for subsequent coding. Finally, both primary and secondary data were categorized into different datasets in preparation for the next step, which involved data analysis.

3.3. Data Analysis: Reliability, Validity, and Research Ethics

The data analysis process involved the examination of both content and photographs. In the content analysis, the focus was on various textual sources, including voice recordings, teaching notes, students' reflective reports, PowerPoint presentations, and food menus. For instance, voice recordings from face-to-face interviews were transcribed into text format for analysis. These texts were coded based on their sources and were cross-verified with the input of students and assisting teachers. This double-checking process was essential to ensure that the analyzed results aligned with the relevant themes. For instance, when analyzing data related to food waste, text mining techniques were applied to the entire set of transcripts. This allowed for the exploration of students' behaviors and attitudes concerning food conservation and recycling, using keywords associated with food waste.

Photographic analysis in this study drew inspiration from Henri et al. [57], who collected records of students' activities through learning photographs. These photographs documented events such as workshops on environmental research, providing insights into how students engaged with Indigenous traditional culture and whether they found Indigenous knowledge in environmental education interesting or not. By examining the characteristics of the photographs, such as the actions captured, the emotions expressed on students' faces, and the environmental issues discussed, it was possible to collect and analyze data related to students' sustainability learning in the different scenarios depicted in photographs or videos. Given that all students possessed smartphones, it was convenient to double-check data with the researcher, making this method an efficient way to collect interactive data from photographs and videos, a practice also adopted in the present study.

Reliability and validity were evaluated using the triangulation method. The data collection and analysis processes demonstrated consistency across various sources, in-

cluding different individuals, locations, and time points. The individuals involved in the study encompassed students, industrial VIPs (representatives from Singapore's seafood company), and departmental faculty members. While the data underwent verification by the researcher, students, and faculty, stringent quality control measures were upheld during the analysis process. In this study, observations were conducted on at least two occasions: one during the welcome banquet and another during the entrepreneurship simulation. Furthermore, the locations where data were collected encompassed the farm, the restaurant, and specialized classrooms, such as those for cooking, baking, and beverage preparation.

Research ethics were determined and acknowledged by Taiwan's MOE, which reviewed this study and found it to be exempt from the need for an Institutional Review Board Statement (IRB). This exemption was primarily based on the fact that the present study did not involve any interventions with animals or human subjects, nor did it employ methods aimed at understanding psychological states or personal secrets. Consequently, the study titled "Applying UNESCO's Framework of ESD for 2030 to Teaching Practices for Responsible Production and Consumption" received approval.

4. Results and Discussion

4.1. *Enhancing Responsible Behavior Through Food and Agriculture Education*

Food and agriculture education was conducted on the school's farm, which received support from the board of directors without any charges. The farm occupies an area of 873 square meters and is typically not used for farming activities. However, during the August semester, it is exclusively allocated for use by the Department of Hospitality Management. The curriculum for food and agriculture education was incorporated into the fourth-grade program of the five-year junior college. This placement was strategic, as following their fourth-grade training, students embark on a 1-year internship in the hospitality industry. As a result, all the necessary industrial skills and knowledge related to food materials, from cultivation to the table, are effectively imparted.

Since different farming approaches directly impact both the environment and farmers' health, we provide a brief overview of the current approach. The three well-known farming approaches are conventional, natural, and organic farming. Conventional farming primarily relies on pesticides, some of which are known to pose serious risks to human health. Natural farming avoids pesticides altogether, utilizing alternative methods such as biological control. Finally, organic farming builds upon natural farming principles but requires certification from local or international organizations to ensure compliance with established standards. In this study, we employed natural farming as an ecological method for agricultural cultivation. This approach utilized microorganisms and a liquid fertilizer, avoiding the use of pesticides that could harm the land and potentially affect people's health when consuming the produce.

The 32 students were divided into six teams, a decision made collectively by the students themselves. Within each team, one student was chosen as the leader, responsible for overseeing assigned tasks and coordinating with team members. Once the teams were established, domain experts provided guidance, alternating between classroom instruction and hands-on work on the school's farm. All students assumed the role of farmers, responsible for planting seeds and tending to them until they matured into vegetables, which were subsequently used in the kitchen for cooking.

Environmentally friendly behavior [43] became evident when students took on the role of farmers, with responsibilities that included nurturing seeds from germination to harvest. This involved tasks such as preparing the land, digging, and weeding. The crops cultivated by the students included water spinach, lettuce, cabbage, and sweet corn.

Through experiential learning [44], one student's experience was selected to illustrate the educational significance of this process.

I do not feel like I work hard, because this course is interesting, and we know how to coordinate when the teacher has assignments. We have 10 plots that must be farmed, which we counted as 1–1 to 1–10. The plots were sown at the same time, because different seeds needed different growing times, and some seeds grow fast such as water spinach. Although we work in the hot weather, my classmates and I do not mind, and it feels different from classroom because we have never had an experience like this. The course is giving us a deep understanding of why my mother always said “please eat food cleanly, do not waste food and let the farmer cry”.

Based on the responses provided by various students, it is evident that the university's social responsibility [58] was successfully fulfilled through environmental education. This was not merely a game related to food played outdoors. The significance of this education lies in connecting the dots between food and human health [1]. While this importance may not need specific emphasis, students experienced firsthand the process of food cultivation without the use of chemical pesticides, helping them understand that irresponsible practices can lead to adverse effects on human health. Another student's response highlighted the environmentally friendly actions taken with an ecological approach, as outlined below.

*We felt so amazed when the teacher set up an insect trap to catch *Spodoptera litura*, which is a kind of pest. The teacher asked us to use an empty PET bottle to make an insect sex pheromone trap. Sex pheromones of a female worm were kept in the bottle, and after several days, male pests came and then died in the bottle. When we counted the corpses of the pests, we felt amazing that we had killed pests without using chemical pesticides.*

Although this was one student's account, she effectively represented the responses of most students. For these students, it was their first time farming and witnessing the use of sex pheromones to repel pests. While the use of sex pheromones may be a straightforward approach for experienced farmers, and empty PET bottles for trapping pests can easily be found near the school, it raised a critical question in the students' minds: “Why do we often see things but still not understand them?” This is similar to saying “We eat pork, but we never see a pig walk.” It started to make sense when their mothers said “If you waste food, it's as if the farmer is crying.” Because the farmers are so far away, it makes one think about who is causing the farmer's distress due to food wastage. Therefore, this hands-on experience was a powerful way of learning by doing.

Therefore, this experience instilled in the students the importance of avoiding food waste and adopting ecological farming practices. In doing so, it aligned with the goals of ESD for 2030 within an unfamiliar context [55] that encompasses sustainability learning. The practical experiences, where students engaged with the land and participated in real-world agricultural production, unveiled this previously unknown context. This revelation signified the occurrence of societal transformation, as students delved into a societal-cultural context interwoven with sustainability learning [24].

4.2. The Green Restaurant: Responsible Consumption in Entrepreneurship Simulation

The student internship restaurant was selected for the implementation of the green restaurant concept. This restaurant primarily served as a support for the school's activities and the banquet planning curriculum. While the restaurant was not open for regular business, it was occasionally used for specific activities ordered by the principal or for teaching purposes related to banquet planning and entrepreneurship simulation. To implement the green restaurant concept, both of these conditions were considered in the sustainability learning program. The banquet-planning teacher is a member of the technical professional

faculty in the Department of Hospitality Management. He brings a wealth of industry experience in restaurant operations, having owned and operated a restaurant in Kaohsiung City, southern Taiwan, for over ten years. As a result, the restaurant's business strategy was guided and overseen by this domain expert, who is also a professional faculty member.

Two banquets were organized by the students themselves, involving various operational aspects such as marketing (including public relations), finance and ticket control, food production and assembly (including desserts and beverages), table service, decoration, and menu design. To connect with the food and agriculture education, some of the food materials used were sourced from natural farming, including sweet corn and cabbage, which helped reduce purchasing costs. As a result, both banquets were successful in accommodating 13 VIPs, as well as 220 students and faculty members from other departments. One of the VIPs was the Chief Operating Officer of Jumbo Seafood in Singapore, and her feedback is provided below.

I am so happy and honored to be invited to this welcome banquet after my speech—The Sustainable Development of Seafood Restaurants in Singapore. I am surprised at how the students can cook Singaporean food. Because Hainan Chicken Rice tasted so wonderful when I ate it in Singapore. But students can make it with local food materials. Those are wonderful cooking skills. If your students want internships in Singapore, I am willing to offer several positions in Marina Bay Sands, where our branch must provide high-level experience. Of course, a higher price is necessary to show a precious meal. Our team endeavors to use sustainable development in human resource management, and we also have different training courses for seafood cooking and purchasing, especially chili crab and fresh fish. We use local food materials which can assure the quality.

The dialogue highlighted a gap between the school and the industry as students mentioned the need to cut costs during the banquet planning process. However, the Chief Operating Officer of Jumbo Seafood offered a different perspective. She emphasized that sustainable practices can still yield a good price. Using local agri-food materials not only keeps the food fresh, but also ensures food safety and health, reducing food loss during long-distance transportation. Moreover, offering safe and healthy cuisine made with local ingredients creates a societal-cultural context that appeals to international customers. Additionally, using local food materials for culinary purposes aligns with the goal of low-carbon production [26], making the restaurant more sustainable and environmentally friendly. This perspective resonated with one of the students, who mentioned the products and services of the green restaurant [38].

We highlighted that our reservations (lunch, dinner, and afternoon tea) were focused on the Singaporean food style, but all the meals were purchased from local agriculture. We worked as a team, from menu design to each delicious food's production and service. Food materials were purchased at a volume suitable to the orders, which ensured that no food from small farmers was wasted. We reused onionskin as detergent, chicken bones to make pottage, and oranges decorated the meals and beverages at the same time. Table setting did not use disposable tableware, and instead used cloth napkins. The real plants and posters promoted the environmentally friendly concept. A QR code was used to understand customer satisfaction and whether the customers knew they were eating local food in a Singaporean style in a green restaurant. I knew at least 90% of the customers, and they were impressed that we are making green foods and beverages in school.

Since the students were tasked with being a green-friendly restaurant (Agriculture Bureau of Kaohsiung City Government) [59], they were guided by six evaluated indicators in their preparations: energy saving, environmental protection, green and safe diet, green actions, health and safety management, and sustainable development. Energy saving

focuses on minimizing the consumption of various energy sources, such as electricity and natural gas. Environmental protection involves using locally sourced food ingredients and implementing recycling practices in food applications. A green and safe diet aims to reduce the risk of chronic diseases by controlling the use of sugar, salt, and oil in cooking, as excessive consumption of these seasonings can negatively impact human health. Green actions refer to the environmental protection measures implemented by restaurants. Business management integrates service operations with sustainability, health, and enterprise development, ensuring a balance between sustainable growth, health, and safety. The evaluated indicators in this study followed a qualitative approach established by Kaohsiung City Government in Taiwan. While this is not a formal research method, it serves as a practical framework for the restaurant industry.

Although this was a student learning activity for entrepreneurship simulation, they also worked on becoming a green-friendly restaurant simultaneously. After the students' activities, they calculated all of their income and expenses. The costs associated with being a green restaurant, such as purchasing locally and avoiding disposable tableware, did not have a negative impact on their overall revenue. In fact, each student received a bonus, although the costs of human resources were not included in the calculation.

4.3. Evaluation of Sustainable Hospitality Education

To assess the students' learning outcomes, a final examination was conducted on 12 January 2024 to evaluate whether students had grasped the basic concepts. The examination consisted of a paper-and-pencil test administered by the researcher. The researcher explained the questions to the students, who then provided their answers. This examination approach was inspired by Kaczynski et al. [60], who used a similar method to evaluate blended learning qualitatively since the chart of visualization is easy to read and understand which indicators are difficult. In this study, six indicators recorded how students worked for a green restaurant.

As mentioned, the primary objective of this study was to incorporate ESD for 2030 into sustainable hospitality education and establish a practical case for sustainable hospitality supply chain management. Consequently, the study focused on assessing whether students had developed responsible behavior and attitudes within a societal-cultural context, with an emphasis on societal transformation. Two crucial criteria were considered: the concept of sustainable hospitality education and the impact of the learner-centered approach. The concept of sustainable hospitality education encompassed various aspects, including food waste, food safety and health, energy conservation, low-carbon operations, and responsible behavior. On the other hand, the evaluation of the learner-centered approach took into account self-directed learning, cooperative learning, project-based learning, problem-based learning, and experiential learning.

The concept of sustainable hospitality education was represented visually in a radar chart, as shown in Figure 1. The chart indicated the extent to which the students had embraced various aspects of sustainable hospitality education. Notably, the students scored highly in areas such as food waste reduction, food safety and health, low-carbon operations, and responsible behavior. These high scores reflected the fact that the students demonstrated a strong understanding of the key principles. For instance, they were adept at managing food waste by accurately estimating the number of attendees and providing takeout containers made of cardboard instead of plastic bags for leftover food. Moreover, they maintained a clean kitchen and ensured proper refrigeration of food materials. Their commitment to low-carbon operations was evident in their preference for locally sourced ingredients and the absence of disposable tableware. Additionally, they actively promoted

environmental conservation through posters in the restaurant and utilized vegetables cultivated using natural farming techniques.

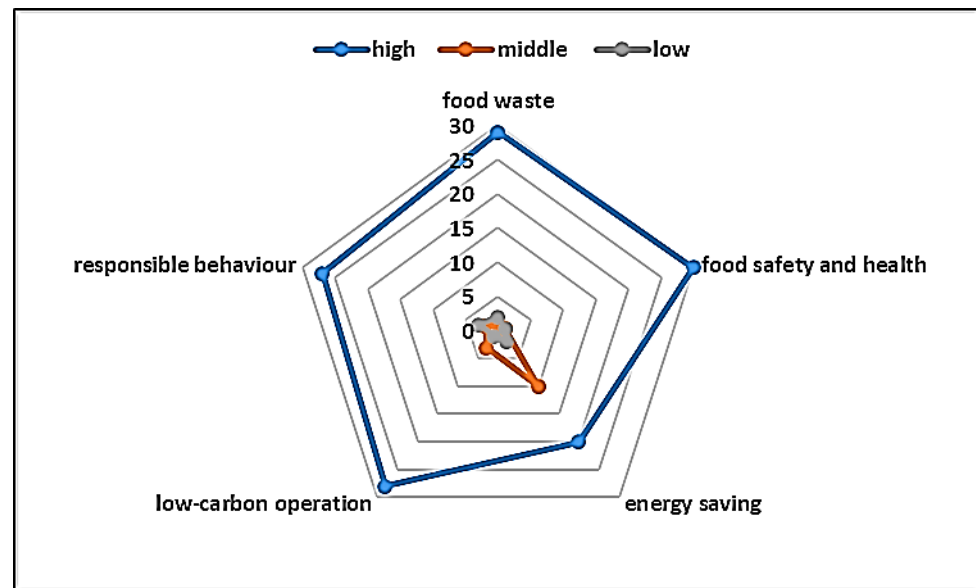


Figure 1. The extent to which the concept of sustainable hospitality education was constructed.

However, there was one aspect where a noticeable difference emerged, energy saving, with only 20 students indicating a positive response. The main reason for this disparity can be explained as follows: while students were able to control water usage efficiently to prevent wastage, managing electricity and gas consumption posed a different challenge. Prior to the actual culinary practices, students required some time to practice and refine their skills, particularly when it came to preparing Singaporean cuisine, which they had not learned from their teachers. Consequently, during the learning process, students needed to use electricity and gas, which incurred additional costs. This expense was justified by the principle of “user pays”, ensuring fairness for all participants.

Regarding the effect of the learner-centered approach connected to different learning outcomes, a radar chart indicates the extent to which they were achieved (Figure 2). Based on the responses from the students, all learning outcomes were influenced by various aspects of the learner-centered approach, demonstrating its effectiveness as a teaching strategy [21]. These outcomes included self-directed learning [46], becoming co-constructors of knowledge [45], experiencing positive changes in student–teacher relationships and overall experiences [47], adopting the role of an activity organizer [48], engaging in learning experiences within learner-centered inquiries [50], and actively learning while enhancing teamwork skills through self-discipline [51]. Consequently, the questions related to self-directed learning, cooperative learning, project-based learning, problem-based learning, and experiential learning were all utilized and successfully achieved.

4.4. Constructing the Conceptual Framework for Integrating ESD for 2030 into Hospitality Education

To synthesize the results of the examined case study, this study constructed a conceptual framework for integrating ESD for 2030 into hospitality education, aligning with the goal of ESD for 2030—societal transformation in business-to-business (B2B) responsible production and business-to-customer (B2C) responsible consumption (Figure 3). This conceptual framework draws upon the concept of sustainable hospitality supply chain management [23] to provide an explanation and understanding of how to implement sustainable hospitality education in Taiwan within the Asia–Pacific context.

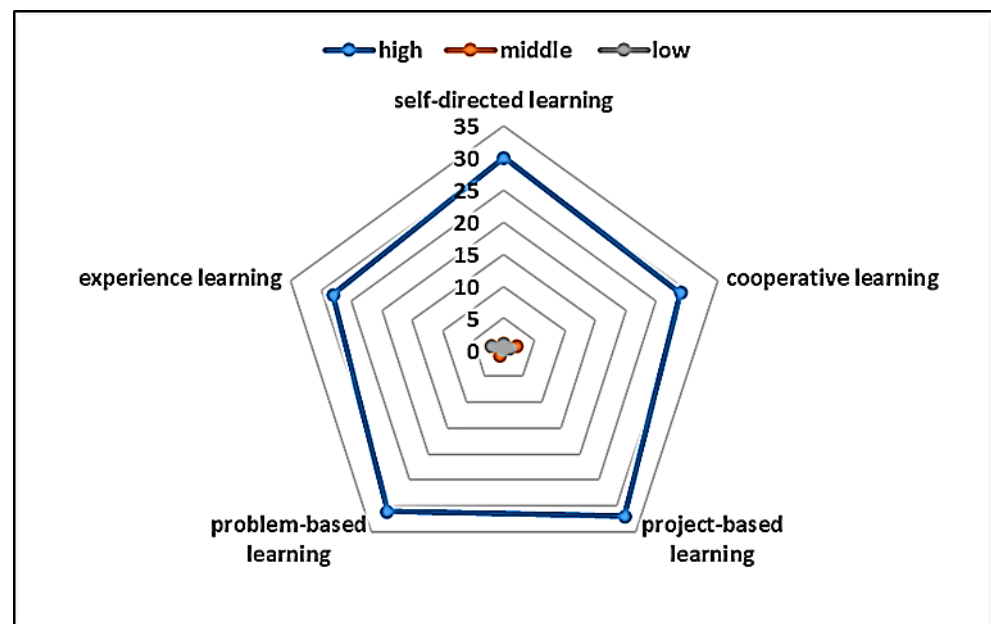


Figure 2. Extent of achievement in learning outcomes through the learner-centered approach.

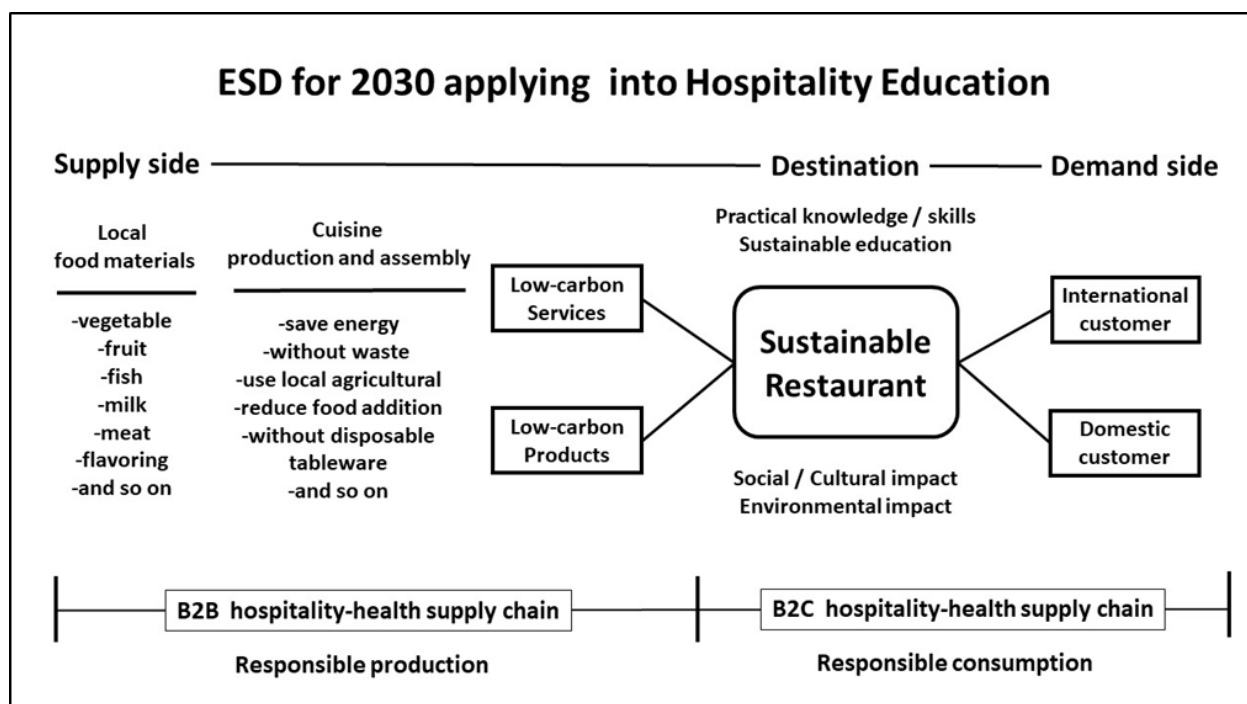


Figure 3. The conceptual framework for applying ESD for 2030 to hospitality education.

A conceptualization of sustainable hospitality supply chain management was adopted to facilitate a comprehensive understanding of the objectives of ESD for 2030. This study primarily focused on SDG 12, which pertains to responsible consumption and production and has direct relevance to the reduction of food waste. Consequently, the examined case study successfully narrowed down its scope to the green restaurant, effectively enhancing the students' responsible behavior and attitudes within the context of societal transformation.

The implications of Figure 3 can be summarized as follows. In this study, ESD for 2030 served as a guide for implementing the concept into hospitality education, ultimately leading to the development of sustainable hospitality education [22]. With the overarching goal of ESD for 2030 focused on societal transformation, educators are encouraged to

make school education more practical and closely aligned with the real world. Therefore, an important sustainable hospitality and health supply chain was created. The sustainable hospitality and health supply chain has practical scope, where real-world operations reflect on how ESD for 2030 applies to hospitality education. The hospitality–health supply chain aims to establish a seamless connection between health and hospitality, spanning from the supply side to the demand side as follows.

- In the B2B hospitality–health supply chain for responsible consumption

The sustainable restaurant, called a green restaurant in this study, in the destination plays an important role in sustainability and serves as a central learning hub within the sustainable hospitality supply chain. It is important to note that this destination can have varying societal, cultural, and economic impacts at the local, regional, and national levels.

To address the demands of both international and domestic customers, the demand side is influenced by unpredictable and dynamic factors related to consumption. In the global hospitality industry, there is a growing need to encourage customers to adopt more responsible and healthy consumption practices.

- In B2C hospitality–health supply chain for responsible production

Consequently, B2C responsible consumption has evolved into the B2C hospitality–health supply chain on the demand side, while B2B responsible production has transformed into the B2B hospitality–health supply chain on the supply side. This shift reflects a clear commitment to sustainability management within the context of sustainable supply chain management.

Therefore, B2B responsible production ensures health and safety in the food chain as a fundamental requirement. All food products, whether they are of original types such as fish or pork, must adhere to strict standards throughout the production, handling, and transportation processes. The same applies to agricultural food products, whether they come from organic or natural farming, and even during the cool logistics phase. Organic and natural farming practices are particularly environmentally friendly, making them a preferred choice [42]. Consequently, places such as supermarkets or restaurants can offer products that prioritize food health and safety within a hospitable environment.

When sustainable restaurants meet the fundamental requirements, low-carbon services or products can be offered to customers. These low-carbon offerings represent a practical approach to reducing CO₂ emissions [26] and minimizing one's carbon footprint [27]. The topic of reducing carbon emissions and the carbon footprint has been widely discussed, particularly during the UN Climate Change Conference—COP 28 (Conference of the Parties, 2023) [61]. The preparation and assembly of cuisine can play a crucial role in reducing the carbon footprint by conserving energy, minimizing waste, utilizing local agricultural products, reducing food additives, and avoiding disposable tableware. However, it is essential to note that this also relates to the broader issue of food waste and loss throughout the entire supply chain, from farm to table.

The integration of sustainable development education in the hospitality industry, starting from food and agriculture education to the green restaurant, has bridged the gap between sustainable theory and real-world operations. This signifies that sustainability learning can be applied within specific contexts to improve students' responsible behavior in both food production and consumption. These practical experiences also have a greater impact within a societal–cultural context, representing another aspect of societal transformation.

5. Conclusions

Food miles are complex [62], since this study illustrated the implemented process, particularly within the context of a green restaurant. It examined the concept of ESD for

2030 and its role in societal transformation. Entrepreneurship simulation serves as a means to learn about the complexities of the real world, as students must learn to balance costs, benefits, and environmental considerations simultaneously. The presented case study provides a comprehensive view of how the farm-to-table program within the Department of Hospitality Management aids students in transforming their responsible behavior and attitudes within a societal–cultural context.

The examined case study has two significant implications: one in education and the other in management. In the educational implication, the learner-centered approach can be effectively employed in sustainability learning. This study has a noteworthy implication as it conceptualizes interdisciplinary knowledge related to food sustainability and translates it into simple living experiences, such as farming and engaging in business through entrepreneurship simulation. This approach allows sustainable hospitality education to align with the concept of a green restaurant.

In the management implication, the agri-food supply chain, which has a broad scope, presents complex challenges within the realm of sustainability science. This complexity implies the need for different managerial concepts to be applied throughout the learning process. Consequently, the case study addresses both the demand side, focusing on marketing management and customer relationship management from reservations to menu selection and dining in an eco-friendly environment, and the supply side, where students learn about entrepreneurship management, purchasing management, cost and financial management, and even crisis management as they encounter unexpected events such as no-show customers and additional orders from external sources.

While this study shed light on an effective approach to acquiring sustainability knowledge through a case study, there are several limitations that should be acknowledged. Firstly, the study's focus was restricted to one university, and the learning environment was situated in a rural area in southern Taiwan. Additionally, all the participants in the study were Taiwanese, with only one foreign participant from Singapore.

The limitations of this study lie in the research methodology and the selection of the learner-centered teaching strategy. While a single case study provides valuable insights, it is insufficient to drive widespread societal transformation. Additionally, although case studies allow for an in-depth exploration of specific contexts, their findings may not be easily generalizable to different settings, such as varying countries or age groups of learners. This makes it challenging to apply the results universally to sustainable hospitality education [22]. Therefore, future research should explore diverse teaching strategies and case studies across different regions and learning demographics. For example, learning psychology still has fewer studies for understanding how and why students learn in a green restaurant in-campus business. Therefore, enhancing students' behavior with the learner-centered approach in sustainable hospitality education can be a more complete practice.

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Informed Consent Statement: Informed consent was obtained from all the participants involved in this study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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