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Introducing Food Sustainability in Formal Education: A Teaching-Learning Sequence Contextualized in the Garden for Secondary School Students

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Abstract: The purpose of this paper is to assess the impact of a garden-based teaching unit about "Food and Nutrition" on students' knowledge and habits of sustainable healthy diets, and to compare it with that of a more traditional unit from a textbook. This communication is framed in a research project (EDUCYL2020-01 "Sembrando interés, cosechando competencia", financed by the Consejería de Educación de la Junta de Castilla y León through the Dirección General de Innovación y Formación del Profesorado (ORDEN EDU/262/2020, de 9 de marzo, *por la que se convoca la selección de proyectos de investigación educativa a desarrollar por equipos de profesores y equipos de inspectores que presten servicios educativos de la Comunidad de Castilla y León durante los cursos 2020/2021*)) whose aim is to improve science education by approaching scientific topics of the official curriculum from a context-based strategy. The authors first designed a teaching-learning sequence, using an organic learning garden as a context, including real-life activities to promote reflection and debate among students. Such a sequence was implemented in a group of 40 students at the third course of Spanish compulsory secondary education, whose results were compared with those of a group of 15 students who followed the textbook. The impact was assessed by posing four open questions to students from the two groups, both at the beginning and the end of the instruction, whose answers were analyzed quantitatively and qualitatively. Results show that implementing the sequence constituted an educational improvement with respect to traditional teaching, since students' answers on the topic were overall more comprehensive and evidenced better preparation for making real-life decisions. Students from the experimental group became more aware of the environmental impacts of human nutrition, and of sustainable healthy diets. It was also indicated that the health and nutrition-centered approach that still predominates in education needs to be overcome, and a sustainable approach needs to be taken. This is a novel study that leads a new line of research devoted to addressing education about sustainable food, which arises from the demands of raising awareness among citizens toward changing diets within the transition toward sustainable food systems.

Keywords: context-based science education; food sustainability; organic learning gardens (OLGs); secondary education

1. Introduction

Nutrition is one of the key elements within the 2030 Agenda with its 17 Sustainable Development Goals (SDG) [1]. In fact, several goals are connected to nutrition in one or more of its dimensions: social, political, economic, and environmental. The most relevant is goal 2, Zero Hunger, whose aim is to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture". Another outstanding goal is number 12, Responsible consumption and production, which challenges us to ensure sustainable consumption and production patterns. This in turn implies some important changes at different levels, such as reducing food wastage (12.3), achieving sustainable management and efficient use of natural resources (12.2), achieving the environmentally sound management of chemicals (12.4), or fostering lifestyle changes through education and raising people's awareness (12.8). Furthermore, there are about 70 different measures connected to nutrition within the framework of other SDGs [2]. Such is the strategic importance of diet, that in September 2021 the United Nations Food Systems Summit was convened with the aim of transforming food systems globally [3]. Both European and international organizations press for the need to adopt diets that are not only healthy, but also sustainable [4,5]. According to the experts, changes in diet would lead to a reduction in the environmental impacts of the agri-food sector [6]. The key lies in how to make diets healthier and more sustainable; they must be freely available, accessible, affordable, safe, and desirable [7].

Teenagers and young people are an important group to focus on in the transition toward sustainable food and agriculture systems because, in the medium and long term, they are the citizens taking part in future food systems [8]. As consumers, their taste in food is for international and/or convenience food, while at the same time, they are statistically more open to vegetarian and vegan food, they enjoy local products, and in general show a positive attitude toward sustainable food [9]. However, their preferences and attitudes do not always result in a change in their food choices. Their behavior is conditioned by a series of factors: holding ecological values, believing that every purchase has a positive effect on the environment, or simply being aware of, or more sensitive to the moral or ethical implications of their food choices [10–13]. It has also been noted that personal health and wellbeing serve as the main motivations for young consumers to get involved in ethical or sustainable food use. In other words, they are more inclined to shop ethically in accordance with the fulfilment of their personal needs (selfish values), than of social needs (altruistic values) [14,15]. Finally, young people who pay more attention to alternative food production have healthier eating habits. They eat more fruit and vegetables, have breakfast, eat less fast food, use less sugar, and drink fewer sugary drinks [16].

This investigation is framed within the field of Education in Sustainable Healthy Food, which looks to foster a change through education, and to raise citizens' awareness toward sustainable and healthy diets, thus contributing to sustainable food systems (SDG 12, goal 12.8). The work already done in this field suggests considering a school setting as a place to foster good practice in food sustainability with an aim to spreading the positive behavior learnt there to home lives. One such good practice is keeping a school vegetable garden, particularly when it is run using sustainable agriculture management practices (organic learning gardens, OLGs [17]). Gardens constitute valuable resources that facilitate achieving several educational objectives, including social and emotional learning [18,19], and address a range of curricular topics, prominently in the areas of food and science education [20]. Regarding food education, garden-based learning programs, particularly when combined with others, such as cooking programs, have been proven to promote knowledge on nutrition, and to improve dietary intake of fruits and vegetables in children and youth [21–24], thus contributing to address some challenging problems of public health, such as overweight and obesity [25,26]. Besides, the positive impacts of school gardening have also been observed to reach families and communities [27], particularly in low-income settings [28]; in fact, gardens are useful for ensuring food safety by providing access to healthy food [29,30]. Throughout the last years, OLGs have also been proliferating in higher education institutions around the world, where they contribute to campus sustainability and sustainability education [31–33]. In many cases, they appear as student-led initiatives [34,35], and act as contexts from where debate and reflection on the impacts of the broader food system on health, society, and environment are promoted [36,37].

In this investigation, we joined together a more traditional approach to healthy food education aiming to improve knowledge on nutrition and dietary intake of fruits and vegetables, with the novel approach of sustainability, and took benefit from the fact that gardening provides opportunities to connect production with consumption to introduce sustainability-related issues such as seasonal food consumption, food transportation, or organic farming. In particular, the aim of this paper is to present a case study in which a didactic proposal on healthy sustainable diets was included in formal secondary education. A research project aiming to improve science education provided us the chance to address certain topics established by the Common Core National Curriculum of compulsory secondary education in Spain (ESO) [38] from a context-based approach [39]. The intention behind this educational strategy is to teach about issues relevant to students' lives [40], help them to apply this knowledge to other real-life situations [41], and foster the students' interest in science and scientific knowledge [42]. One of the curriculum topics is "Food and Nutrition". Thus, the authors designed and implemented a work unit that used an OLG as a real-world context, and afterward compared its impacts on knowledge and attitudes toward sustainable healthy diets with those of the traditional unit from the textbook. The research questions were:

1. Are students able to explain what a healthy diet is after instruction? Are such explanations more complete in the experimental group of students?
2. Are there shifts in the criteria that students use when choosing the food they eat, either in the experimental or in the control groups?
3. Are students capable of explaining the relationship between growing a vegetable garden, their own health, their local environment, and the planet? Are such explanations more complete in the experimental group of students?

2. Materials and Methods

2.1. Didactic Design

It was decided to design a teaching unit in the form of a teaching-learning or didactic sequence (TLS hereafter), which was named, "If we cultivate our own vegetable garden, will we eat better?" (Appendix A). TLS consist of small or medium-scale curricular products that cover the teaching and learning of a specific scientific topic [43]. From the teacher's point of view, designing sequences means choosing activities and organizing them following a structure with a common theme; thus, it involves making decisions on two levels: macro—to ensure consistency throughout the sequence, and micro—for each session [44]. From the existing choice of design proposals available, the authors have used that of [45] and [46], who follow a socio-constructivist perspective and recommend a layout with three stages: the first stage includes topic presentation, eliciting students' previous knowledge and misconceptions, and motivating them to learn; the development stage is focused on knowledge reconstruction and includes different types of both individual and group activities; and the final stage should be useful to summarize, apply, and assess the content that has been worked on throughout the sequence.

The TLS set out a core question with a range of expected scopes for answers:

- Yes, because the vegetable garden provides us with fruit and vegetables, which are rich in vitamins and minerals and do not contain additives;
- Yes, because if we raise crops, we can decide how to manage the land, and ecological management practices mean food with a higher nutritional quality and better organoleptic characteristics;
- Yes, because we foster seasonal food consumption, which is more sustainable for the planet;
- Yes, because we partly fulfil our nutritional needs, bringing us closer to a healthy diet and a Mediterranean diet.

The TLS posed different types of activities, as recommended in literature [45,46], including laboratory work (e.g., a semi-quantitative assessment of the nutrients to be found in some of the produce from the garden), qualified scientific data handling (from scientific articles and data tables) as recommended in science education to promote scientific literacy [40], real life experiences (such as analyzing food labels, visiting a market or supermarket, or talking to older family members about diet), and much pooling of ideas, debates, and critical reflections among peers, as recommended in sustainability education [47].

2.2. Research Design and Data Collection

This research included an experimental and a control group of students. In both groups, the issue "Food and Nutrition" was approached based on different methodologies: a constructivist, context-based TLS vs. a traditional textbook unit. To collect data, four open questions were posed to all students at the beginning and at the end of instruction, which were afterward analyzed. Learning was thus measured as a distance in students' knowledge and habits of sustainable healthy diets (final-initial). Results were expected to be useful to evaluate the TLS itself, as recommended in literature [44], and thus to provide feedback to be considered in a subsequent cycle of design (redesign-implementation-assessment), as following the patterns of design-based research (DBR), a well-recognized methodology in the field of science education [48–50].

Specifically, this study considered an experimental group formed by 25 and 23 students, respectively from classes 3 C and 3 D, who were taught using the TLS, and a control group of 20 students from classes 3 AB, who were taught using the unit "Food and Nutrition" from the designated textbook [51], based on transmission teaching, and by a different teacher. All students were from Anonymous Secondary School (anonymous city, Spain), and could be approached because of having previously won a competitive regional research project that provided the permission to investigate with them. Students from both groups were asked to fill in an online questionnaire posing the following four open questions, both at the beginning and at the end of the unit:

1. What advantages do you think growing a vegetable garden has on your health, on the planet, and on your local environment?
2. Are you worried about eating well?
3. What things do you bear in mind when you decide on what to eat? (pre), and: Are you now more concerned about eating well than before beginning this unit? What things do you now consider when you choose what you eat compared to before you began this unit? (post)
4. What do you consider to be a healthy diet?

Such questions referred to the contents that would be approached by the TLS, since their aim was to assess students' learning, but also the usefulness of the selected approach (constructivism, context-based science education).

2.3. Data Analyses

Answers from pupils who did not fill in both questionnaires were not analyzed, giving us a total of 40 students' paired responses from the experimental group and 15 students' paired responses from the control group. Answers were first classified by their quality by a researcher who was not involved in didactic implementation with students, awarding points using the following scale:

1. Incorrect or very confusing answers;
2. Answers that were only partly incorrect;
3. Very simple answers;
4. More complex answers that showed critical thought.

A qualitative analysis was conducted exclusively on the answers of quality 4 on the scale by using MAXQDA Analytics Pro 2020 software, by considering the following categories, which corresponded to the questions posed to students, and were aligned with teaching objectives (in the domains both cognitive-knowledge-and behavioral-habits-learning):

- **Category 1 (Cat1)—**The advantages of growing a vegetable garden for our health;
- **Category 2 (Cat2)—**The advantages of growing a vegetable garden for the environment;
- **Category 3 (Cat3)—**Personal criteria for choosing food;
- **Category 4 (Cat4)—**Knowledge of a balanced diet.

Constructing an inductive system of subcategories accounted for the meanings of answers [52,53]. Moreover, a quantitative analysis was conducted with the software SPSS v.20, which consisted of a Mann-Whitney U test to compare the average value of the quality of the answers between the experimental and control groups before instruction (with the aim of making sure that there were no initial differences between the two), and a Wilcoxon signed rank test to compare the quality of the answers between the beginning and the end, which was conducted for each content category and for both groups. Effect sizes were calculated according to [54] and interpreted according to [55].

3. Results

3.1. *Quantitative Analysis of Change*

The quality of the answers is shown in Table 1. Only the questions in Cat3 and Cat4 were answered by all students, both initially and finally. Furthermore, they were also the categories with the highest mean values of quality in both groups.

Table 1. Number of students who answered each content category (N) and mean value of the quality of answers for the experimental and control groups, before and after instruction.

		Cat1		Cat2		Cat3		Cat4	
		Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
Control	N	14	15	13	13	15	15	15	15
	Mean	2.71	3.00	2.54	2.54	2.80	3.20	2.73	3.20
Experimental	N	37	37	29	32	40	40	40	40
	Mean	2.49	2.92	2.34	3.09	2.63	3.35	3.05	3.25

Table 2 shows the statistical comparison of the mean values of quality of initial answers between experimental and control groups; no significant differences were observed in either. The students' marks in the subject "Biology and Geology" in the first term—before instruction on "Food and Nutrition"—were also compared, and no significant statistical differences were observed in the mean academic performances of the experimental and control groups (U = 237,000, *p*-value = 0.216). The effect size was medium (Z = −1.237, r = −0.167).

Table 2. Statistical comparison of the mean values of quality of students' answers to the initial questionnaires between the experimental and control groups, using the Mann Whitney U test.

Group	Cat1	Cat2	Cat3	Cat4
Mann-Whitney U test	231,000	169,500	281,000	255,500
Significance level	0.533	0.591	0.704	0.423
Z value	−0.623	−0.537	−0.379	−0.942
Effect size (r)	−0.087	−0.082	−0,051	−0.127

Note. Significant *p*-values: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The statistical comparison between the quality of answers initially and after instruction is shown in Table 3. In the control group, no significant differences in the quality of the answers were observed in any of the content categories. However, in the experimental group, significant differences were observed in Cat 1, Cat2, and Cat3; the only category with no significant change was Cat4.

Table 3. Wilcoxon signed rank test for the quality of answers of experimental and control groups (post-pre). The values correspond to statistic Z.

Group	Cat1	Cat2	Cat3	Cat4
Control				
Z-value	−0.905	−0.577	−0.988	−1.552
Effect size (r)	−0.242	−0.174	−0.255	−0.401
Experimental				
Z-value	−2.109 *	−2.172 *	−3.781 ***	−0.844
Effect size (r)	−0.361	−0.453	−0.598	−0.133

The statistic value Z is based on the negative ranges in all cases, and it should be taken that the difference between post−pre was positive more times that negative. Significant *p*-values: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. According to [56], effect size may be interpreted as small when r > 0.1, medium when r > 0.3 and large when r > 0.5.

When exclusively answers on the level of quality 4 were analyzed, it indicated that the number of students who gave them doubled in all the content categories in the experimental group. However, the number of students only doubled in Cat1 and Cat3 in the control group (Table 4).

Table 4. Number of students who gave answers at level 4 in quality, before and after instruction. In brackets, the calculation of the percentage out of the total number of students in each group.

Group		Cat1	Cat2	Cat3	Cat4
Control	Before	2 (13%)	2 (13%)	4 (27%)	4 (27%)
	After	6 (40%)	2 (13%)	8 (53%)	5 (33%)
Experimental	Before	6 (15%)	5 (13%)	8 (20%)	11 (28%)
	After	14 (35%)	13 (33%)	20 (50%)	22 (55%)

Again, when exclusively answers on the level of quality 4 were analyzed, it was observed that the number of text fragments per category doubled in all the content categories except in Cat4 in the experimental group, and except for Cat2 and Cat4 in the control group (Table 5).

Table 5. Number of text fragments obtained for each content category in answers at level 4 in quality. In brackets, the calculation of the percentage out of the total number of students in each group.

Group		Cat1	Cat2	Cat3	Cat4
Control	Before	2 (13%)	2 (13%)	4 (27%)	5 (33%)
	After	7 (47%)	2 (13%)	10 (67%)	8 (53%)
Experimental	Before	8 (20%)	7 (18%)	13 (33%)	14 (35%)
	After	26 (65%)	18 (45%)	37 (93%)	26 (65%)

3.2. Qualitative Analysis of Change

3.2.1. Advantages of Growing a Vegetable Garden for Health

Table 6 shows the system of subcategories obtained based on students' answers to the question about the advantages of growing a vegetable garden for health.

Most of the text fragments were directly related to food production, with healthy ("natural") products being the most mentioned content subcategory. Being healthy was linked to the idea that in personal vegetable gardens, chemical products such as pesticides or chemical fertilizers are used less frequently, as opposed to shop-bought food, their composition being unknown and considered to be less healthy. Similarly, students connected home-grown food to being "fresher" or "tastier", and considered that gardening allows them to carry out self-consumption food and culinary practices, which they also valued as healthy because they are outside the domain of the food industry:

> The products that you produce are healthier than ones you buy in a supermarket because those from the supermarket have chemicals, pesticides, and things like

> this to make the products look better, but they aren't as healthy as the ones that you produce in your garden. (3C, post)
>
> You are cultivating in a fertile soil that has not been used before, this provides you with natural food without chemicals. This reduces the consumption of some chemicals (that) food factories add to food to make it tastier, give it an excellent texture, of even providing a lovely smell. Vegetables you grow with compost are tastier, they are even more nutritious, and you can make your own products with them like tomato sauce, vegetable soup or even jam. (3D, post)

It should be noted that students had not related growing their own vegetable gardens with a tasty, healthy diet before the teaching sequence; it was only observed in the members of the experimental group and after the TLS.

Table 6. Subcategories for Cat1.

Subcategories	Control		Experimental	
	Before	**After**	**Before**	**After**
Healthy ("natural") products	2	5	6	14
Producing food to eat in a healthy way	-	-	1	5
Food is tastier and/or looks healthier	-	-	-	4
Physical exercise	-	2	1	1
Prevent illnesses	-	-	-	1
Spend time with family/friends	-	-	-	1
Total	2	7	8	26

3.2.2. Advantages of Growing a Vegetable Garden for the Environment

Table 7 shows the subcategories emerging from students' answers to the question about the advantages of growing a vegetable garden for the environment, including their local surroundings and the planet.

Table 7. Content subcategories for Cat2.

Subcategories	Control		Experimental	
	Before	**After**	**Before**	**After**
Less pollution	1	-	5	14
It is good for the (local) ecosystem	-	2	1	1
Soil preservation	-	-	-	2
More vegetation	-	-	1	-
Preservation of local crops	-	-	-	1
A more sustainable way of producing our food	1	-	-	-
Total	2	2	7	18

This table shows the main effects that instruction through the TLS had on students in the experimental group. Most of the text fragments referred to the idea that reducing pollution is one of the environmental advantages of growing a vegetable garden, increasing from 5 (pre) to 14 (post). There were two main arguments: first, the belief that, contrary to traditional farming, in ecological farming pesticides and chemical fertilizers are not used, and second, that home-grown food does not require plastic wrapping or need to be transported long distances as it is grown and eaten locally, as opposed to supermarket produce. There was also a link, albeit lower, to a decrease in the levels of greenhouse gas emissions and water pollution:

> If we consume garden products, we help the environment because pesticides and chemicals are not used in these products, so we don't pollute the air and the atmosphere. Another aspect is that we do not need to transport them for long

distances, so we do not use plastic to wrap the food and we produce less bad gases than by using transport. (3C, post)

Gardening is good for the planet because you eat fruit and vegetables grown in your own home, which means you do not need to buy them in the supermarket where they are wrapped in plastic. Less plastic means less pollution, so it is better for the planet and your immediate environment. (3D, pre)

One interesting observation in both groups is that using less synthetic chemical products was attributed more importance in relation to secondary health effects than to impacts on the environment. Another point worth mentioning is that, although students were asked about the impact on their local, surrounding environment and the planet, they generally commented more on the planet.

3.2.3. Personal Criteria for Choosing Food

Tables 8 and 9 show the subcategories gained from students' answers to the criteria they use when choosing food, before and after the instruction, respectively.

Table 8. Subcategories for Cat3, before instruction.

Subcategories	Control	Experimental
Nutrients and/or calories	3	5
Food groups (vegetables, fruit, meat, fish . . .)	1	5
Food as less processed as possible	-	3
Healthy	-	1
Total	4	14

Table 9. Subcategories for Cat3, after instruction.

Subcategories	Control	Experimental
Yes, I keep in mind the nutritional value and variety of food	4	15
Yes, I consider the origin of the food	-	8
Yes, by checking what ingredients are in food	3	6
Yes, I choose ecological food		4
Yes, by eating well you are healthier	3	1
Yes, I try to drink enough water	-	1
No, I have the same interest as before	-	2
Total	10	37

Both before and after instruction, the most frequent criterion referred to was the group to which the food belonged, i.e., students said they took into account whether the food was a vegetable, fruit, meat, fish, pulse, etc. This was followed by the criterion of the nutritional content: carbohydrates, protein, fat, etc., and calories. Moreover, students from the experimental group said they considered whether it was low-processed food and could be cooked at home—not precooked food. Accordingly, both the experimental and the control groups, particularly after instruction, showed general concern for the additives used in food, especially the E-numbers of food additives commonly used by the food industry.

These criteria were related to the importance of following a varied diet, in particular the Mediterranean diet. Both groups of students, control and experimental, showed that through the instruction they learned to look at how balanced their diets are, adapting them to try to follow a healthier diet, as well as a more sustainable one (less meat). Notably, while the number of text fragments per student stayed the same in the control group, they increased in the experimental group.

Yes, now I try to eat less meat, eat more fruit and vegetables, try to cook with virgin olive oil instead of butter, and I try to make my own meals in home instead

> of buying them (pre-cooked meals). Now I also try to look at the ingredients and E numbers of the food [, and] I buy and consume the most natural ones. (3C, post)

> I think I changed my mind because I go with my mom to the supermarket now, I compare what food contains, which additives contain food like emulsifiers, flavourings ... I also observe how nutritive food is. I have also started following a balanced diet by increasing the number of vegetables and fruit I eat. I have also decreased the portions of meat I eat a day and have stopped eating so much red meat. I have started looking at the E numbers and I also look to find local or national products instead of "petro food". (3D, post).

Another finding that stands out is how two other new criteria only appeared in the experimental group: the geographical source of the food (eight text fragments), and how "natural" they were (four text fragments), as in non-convenience food items, and in general not using plastic and derivates in food packing.

> Thanks to this unit, I have realized the importance of eating well. I did not know what "petro food" meant and how important of origin of our food was. From now on, I will try to consume local products. (3D, post)

3.2.4. Understanding a Balanced Diet

Table 10 shows the subcategories that emerged from students' responses to the question about what they considered to be a balanced diet.

Table 10. Subcategories for Cat4.

Subcategories	Control		Experimental	
	Before	After	Before	After
Eating a variety of food, but less of some food groups	1	5	8	19
Limiting weekly consumption of certain foods	3		3	2
"Eat healthy"			1	2
Several (5) meals a day		2	1	1
Physical exercise	1	1	0	2
Drink water			1	0
Total	5	8	14	26

As previously stated, the students' most common idea of a healthy diet was decided by the variety of food eaten, depending on the food group and nutrients. This means that they considered that a balanced diet should include different types of nutrients and food, in specific quantities, and some even recommended a certain weekly intake. However, some also believed that physical activity should be included as a complementary habit to follow a healthy lifestyle. This series of references was practically unchanged in the control group (four accounts at the beginning; five at the end), while in the experimental group, there was a considerable increase in the mentioning of these ideas (from 11 to 21 accounts). Nevertheless, it should be noted that these recommendations were mentioned before instruction, particularly those relevant to the weekly consumption of the food groups.

> A balanced diet must be a balanced diet, combined with exercise. To have a healthy diet, you need to eat several meals a day in small quantities to help your organism to digest the food. A balanced healthy diet must follow the food pyramid. (3AB, post).

> I consider that a balanced diet should include a wide variety of food, including proteins, starch, carbohydrates ... Obviously consuming the correct amount. (3AB, pre).

> Now, I consider a balanced diet to be a diet that has different foods throughout the week. We have to eat several fruits and vegetables a day (fibre), fish and meat like poultry (to obtain protein), on some days, pulses instead of meat (they also

> give us proteins), dairy products such as yogurt and cheese, and eat a limited number of sweets, fats, salt and red meat. We need to have a balanced diet to obtain all the nutrients our body needs to perform its vital functions. (3D, post).

> I think that a balanced diet is to eat five pieces of fruit every day, drink a lot of water, keep yourself hydrated, do exercise, eat meat and fish 3 times a week and don't eat an excess of carbohydrates. (3AB, pre).

4. Discussion

This paper presents a study case in which the novel topic of sustainable healthy food was introduced in formal education, as following the needs highlighted by international organizations and experts [6–8]. The achievement of a competitive educational project—aiming to improve science education by designing work units on certain topics established by the Common Core National Curriculum [38] from a context-based approach—allowed us to work with secondary students with the final objectives of promoting their scientific literacy, and their interest in science. One such topic was "Food and Nutrition", for which a teaching-learning sequence was designed, which is presented here as Appendix A. The sequence showed three distinctive features: (1) it used a school vegetable garden and included real-life activities such as visiting the market and supermarket to take data on fruit and vegetables such as the variety, origin and price, analyzing labels on processed food, and talking to older family members about typical diets for different generations; (2) it included content more directly related to food sustainability, such as ecological agriculture, food transport, eating seasonal fruit and vegetables; and (3) it aimed to foster critical thinking and debate with peers rather than the memorization of facts. The sequence was implemented in a group of students, and their results were compared with those of a control group of students who followed a traditional unit from the textbook. Following recommendations of didactic design, the assessment was done by collecting pre and post data [44] in both cases.

Results offer evidence of how students from the experimental group provided quality answers reflecting a wider understanding of the whole topic; they learned significantly and thus got prepared not only for subsequent formal learning, but also for making real-life decisions and for life-long learning, which are among the main objectives of science education [42] and of the European model of teaching-learning through competences [56]. Plenty of evidence was gathered to support these ideas: first, whereas in the control group not statistically significant pre/post changes were observed in the quality of students' responses—for any content category—in the experimental group, statistically significant pre/post changes occurred in most content categories, with the only exception of "healthy diet". Second, the number of students who gave quality 4 answers at least doubled in the experimental group for all content categories, including "healthy diet", whereas only doubled for categories 1 and 3 in the control group. Finally, the number of text fragments per category also doubled in the experimental group for most content categories, except for "healthy diet", and only for categories 1 and 3 in the control group. Overall, these results must be interpreted as a success of the TLS methodological approach, which provided students with more elements to interconnect ideas in such a way that their answers were more comprehensive. The importance of real-life experiences to learn about sustainability issues has previously been pointed out [47].

It was observed that all students from both groups answered the questions regarding "criteria I use to choose food" and "healthy diet", and moreover achieved the highest values of quality of answers in these two content categories. This is probably due to the fact the topic "Food and Nutrition" is addressed in primary education, from year 2 to year 6 in Spain [57]. Accordingly, "healthy diet" was the content category for which less pre/post change was observed in the number of fragments—for both groups—and the only one in which there was not statistically significant pre/post change in the quality of answers in either group. The case was the opposite to the content categories "advantages of growing a vegetable garden for one's own health", and "for the local environment, and the planet"; not all students answered these questions. The environmental impacts of human nutrition are not explicitly addressed by the Spanish curriculum, with only one exception: in year 4 of Compulsory Secondary Education, energy and matter flow within ecosystems are related to nutrition [38], for which the topic of diet is perceived exclusively in terms of health-nutrition [58]. In this study, improvements occurred in the control group regarding "advantages of gardening for one's own health" when considering the pre/post change both in the number of students who gave complex answers (value 4 on the scale), and in the number of text fragments. This must be considered a positive outcome compared to the traditional approach to the topic "Food and Nutrition" but note that a lack of content on sustainable healthy diets persists, which needs to be changed to approach recent international recommendations [4–6].

In the experimental group, students learned about the environmental impacts of agriculture and human nutrition, which provided them with new criteria to choose food, such as geographic origin [9,59], or "naturalness". Consumers' perceptions of naturalness are important for the acceptance of foods, but the aspects that are considered essential in perceiving a food item as natural may vary across consumer and stakeholder groups [60]. In this study, students mentioned, among other things, the fact that food is not precooked. This reference to the fact that food can be cooked at home is new, especially as in the social group teenagers belong to, and the consumption of ultra-processed food and fast food prevails [61,62]. Namely, students gave value to cooking and how food is prepared, a value not commonly demonstrated among young people and rarely linked to a healthy diet. Nevertheless, our students had more contact with cooking during the COVID-19 lockdown as families in general spent more time cooking together [63,64]. Students, indirectly, also mentioned criteria for choosing food found in the guiding principles for sustainable healthy diets: food not packaged in plastic, eating more locally or organically grown food, eating less meat, and reducing food transport [4].

It is worth noting that allusions to the benefits of reducing the use of synthetic agrochemicals were scarcer regarding the environment than regarding health, in both groups of students. This could be related to the fact that both the textbook and the TLS were more focused on food and health. However, it has been observed that, behind the positive attitudes toward sustainable food of young people, there are more individualist values at play, such as health and personal wellbeing, than altruistic values like concern for the environment [14,15]. Another interesting observation is that, although they were asked about their local environment as well as the planet, their references were generally toward the latter. There is a possible risk that the abundant references toward sustainability and caring about the planet in public speeches are acting as a kind of "slogan" and becoming meaningless to the youth of today [65]. Reports by experts are being published [6] and government strategies [4,5] have taken on board the social impact and the consequences of diets on the planet [7], but studies show that these aspects have still not been embraced by the Spanish population [66]. In any case, this evidence supports the idea that it is important to raise these issues in a teaching-learning context as true to real life as possible.

In relation to the design and educational value of the TLS, "If we cultivate our own vegetable garden, will we eat better?" and considering the results, the design proved to be useful. A strong point of the TLS is its flexibility; some activities can be avoided, and others added. This characteristic has been highlighted as outstanding in TLS design [43]. An important aspect to be included by means of new, purposely designed activities in a subsequent cycle of design (including redesigning the sequence in the light of research results, implementing it, and evaluating it, as recommended by [48–50]) is addressing the advantages of growing a garden specifically for the local, surrounding environment.

Regarding study limitations, it is worth noting that this study aimed to be a quasi-experimental design including a control group, although the size of the control group was low. Investigating using secondary students was possible for us because of a regional research project, which gave us permission to obtain data from a particular center of secondary education. The topic "Food and Nutrition" is addressed in the third course, and the authors used the available sample: the classes of the teacher who participated in the research, as the experimental group, and the class of another teacher who agreed to collaborate, as the control group. It is noteworthy that educational comparisons between control and experimental groups ignore the psycho-cognitive history of the students, the interactions within the group, and the role of the teachers, for which some authors do not consider them suitable [44]. However, the authors considered it valuable to have information from a similar group of students that followed traditional instruction, to contribute to evidence, either in one sense or another.

5. Conclusions

This study presents a successful example of the introduction of the novel topic of sustainable healthy food in formal education, by means of the design of a TLS and its implementation with 14/15-year-old students from a Spanish secondary education center. This case study indicates that contents related to the health dimension of the topic "Food and Nutrition" had already been assimilated by students throughout their primary education, so what really becomes important in the current global context of the need for the transformation of production and consumption systems is attending to other dimensions, notably the environmental impacts of diets [58]. Using a garden as a real context to pose the core question ("If we cultivate our own vegetable garden, will we eat better?") and real-life activities proved both to be useful [39,47] to promote an authentic science learning experience and, in turn, to prepare students for real-life decisions and life-long learning, which constitute the main objectives of science education [42,56]. It also reinforced how gardens constitute valuable didactic resources for both food and sustainability education [18–30] and provided a case study in the novel path to Education in Sustainably Healthy Food. This paper brings to the table that these types of innovative educational experiences are not only necessary but can successfully contribute to the formation of a sustainable citizenship.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the educational research project EDUCYL2020-01 for studies involving humans. It was carried out following the legal guidelines for conducting educational research with secondary students.

Informed Consent Statement: Informed written consent was obtained for all subjects involved in the study from their parents or legal guardians.

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Appendix A

Table A1. Scheme of the TLS "If we cultivate our own vegetable garden, will we eat better?" including activities distributed in three stages. Designed by: Authors 1 and 2.

Temporary Dedication: 14 Sessions of 50′ + Homework (1 h 20′)					
Activities					
Fase/Activity Number		**Short Description**	**Social Org.** [1]	**Resources**	**Temp**
Initial	1	Short oral introduction	CL	None	10′
	2	Initial ideas' elicitation	I	Open questionnaire (FORM 1)	40′
Development	3	What is in our garden's vegetables? Chemical analyses of nutrients in the laboratory	WG	Laboratory, reactants, vegetables	50′
	4	Who is who? Dealing with data tables to grouping food based on their characteristics	WG + CL	Data tables on nutrients contents	35′ + 15′
	5	Master lecture on nutrients (carbohydrates, lipids, proteins, mineral salts, water, vitamins)	CL	Presentation	50′
	6	Classroom practice on label interpretation: What is in the transformed products of the garden that I buy?	WG + CL	Products such as fried tomato, jams, syrups, precooked legume dishes	40′ + 10′
	7	Video viewing: Why are there foods that attract me so much? Information search: Do additives have consequences on human health?	WG + CL	Youtube: "America's addiction to salt, sugar, and fat"	35′ + 15′
	8	Video viewing: Do land practices matter?	WG	Youtube: "Two tomatoes and two destinations", "Take care of the roots", "Better save the soil"	15′
	9	Classroom practice on data interpretation: Do products organically vs. conventionally produced contain equal amounts of nutrients?	WG + CL	Article "Vitamin C content from conventional vs organic farming" (real data)	25′ + 10′
	10	Seasonal fruits and vegetables	WG + CL	Open questionnaire (FORM 2), seasonal calendar	20′ + 30′
	11	Homework: What can be bought and at what prizes? Let's go to the market and take notes	I + CL	Excel file	50′

Table A1. *Cont.*

Temporary Dedication: 14 Sessions of 50′ + Homework (1 h 20′)					
Activities					
Fase/Activity Number		**Short Description**	**Social Org.** [1]	**Resources**	**Temp**
Development	12	Sharing data Video viewing: What are the environmental advantages of producing food nearby? Information search: What is petrofood? Debate: How much does it cost to the planet that I follow an unseasonal diet?	WG + CL	Youtube: "to the corner garden"	30′ + 5′ + 15′ + 25′
	13	Homework: How did different generations eat? Talk to you parents and grandparents Debate: How much food proceeds from the garden, now and before?	I	Excel file	30′
	14	Classroom practice: construct the diet of those three generations, and compare them with the standards of "balanced diet" and "Mediterranean diet"	WG	Standards of "balanced diet" and "Mediterranean diet"	25′ + 25′
	15	Master lecture: nutritional needs (structural needs, energy needs, functional and regulatory needs)	CL	Presentation	50′
Final	16	Problem-situation: analyze a diet to the light of all that you have learned	I	Open question (FORM 3)	25′
	17	Final ideas' elicitation	I	Open questionnaire (FORM 4)	40′

[1] I = individual; WG = work Groups; CL = class. Note that it is customary to work in groups, and then pool the results obtained and discuss them as together.

References

1. Resolution A/RES/70/1 Transforming Our World: The 2030 Agenda for Sustainable Development. Available online: https://sustainabledevelopment.un.org/index.php?page=view&type=111&nr=8496&menu=35 (accessed on 28 December 2021).
2. Sage, C.; Quieti, M.G.; Fonte, M. Sustainable Food Systems. Sustainable Diets. *Int. J. Sociol. Agric. Food* **2021**, *27*, 1–11. [CrossRef]
3. Food Systems Summit 2021. Available online: https://www.un.org/es/food-systems-summit/about (accessed on 28 December 2021).
4. Food and Agriculture Organization of the United Nations-FAO; World Health Organization-WHO. *Sustainable Healthy Diets-Guiding Principles*; FAO and WHO: Rome, Italy, 2019. Available online: https://www.fao.org/documents/card/es/c/ca6640en/ (accessed on 10 January 2022).
5. European Commission. Farm to Fork Strategy. For a Fair, Healthy and Environmentally-Friendly Food System. 2020. Available online: https://ec.europa.eu/food/sites/food/files/safety/docs/f2f_action-plan_2020_strategy-info_en.pdf (accessed on 28 December 2021).
6. IPCC. *Climate Change and Land-IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*; Intergovernmental Panel on Climate Change: Geneva, Switzerland, 2019. Available online: https://www.ipcc.ch/srccl/ (accessed on 16 January 2022).
7. Lang, T. The Sustainable Diet Question: Reasserting societal dynamics into the debate about a Good Diet. *Int. J. Sociol. Agric. Food* **2021**, *27*, 12–34. [CrossRef]
8. Bumbac, R.; Bobe, M.; Procopie, R.; Pamfilie, R.; Giusca, S.; Enache, C. How Zoomers' Eating Habits Should be Considered in Shaping the Food System for 2030-A Case Study on the Young Generation from Romania. *Sustainability* **2020**, *12*, 7390. [CrossRef]
9. Vermeir, I.; Verbeke, W. Sustainable food consumption among young adults in Belgium: Theory of planned behavior and the role of confidence and values. *Ecol. Econ.* **2008**, *64*, 542–553. [CrossRef]
10. Allen, M.W.; Spialek, M.L. Young millennials, environmental orientation, food company sustainability, and green word-of-mouth recommendations. *J. Food Prod. Mark.* **2018**, *24*, 803–829. [CrossRef]

11. Lago, N.C.; Marcon, A.; Ribeiro, J.L.D.; de Medeiros, J.F.; Briao, V.B.; Antoni, V.L. Determinant attributes and the compensatory judgement rules applied by young consumers to purchase environmentally sustainable food products. *Sustain. Prod. Consum.* **2020**, *23*, 256–273. [CrossRef]
12. Kuzniar, W.; Surmacz, T.; Wierzbinski, B. The Impact of Ecological Knowledge on Young Consumers' Attitudes and Behaviors towards the Food Market. *Sustainability* **2021**, *13*, 1984. [CrossRef]
13. Tepper, S.; Kaufman-Shriqui, V.; Shahar, D.R. Mapping Young Adults' Concerns and Attitudes toward Food-Related Sustainability Issues in Israel: Implications for Food Policy. *Nutrients* **2020**, *12*, 3190. [CrossRef]
14. Oke, A.; Ladas, J.; Bailey, M. Ethical consumers: An exploratory investigation of the ethical food consumption behavior of young adults in the North East of Scotland. *Br. Food J.* **2020**, *122*, 3623–3638. [CrossRef]
15. Pham, T.H.; Nguyen, T.N.; Phan, T.T.H.; Nguyen, N.T. Evaluating the purchase behaviour of organic food by young consumers in an emerging market economy. *J. Strateg. Mark.* **2019**, *27*, 540–556. [CrossRef]
16. Pelletier, J.E.; Laska, M.N.; Neumark-Sztainer, D. Positive Attitudes toward Organic, Local, and Sustainable Foods Are Associated with Higher Dietary Quality among Young Adults. *J. Acad. Nutr. Diet.* **2013**, *113*, 127–132. [CrossRef]
17. Eugenio-Gozalbo, M.; Pérez-López, R.; Tójar-Hurtado, J.C. Identifying key issues for university practitioners of gar-den-based learning in Spain. *J. Environ. Educ.* **2020**, *51*, 246–255. [CrossRef]
18. Block, K.; Gibbs, L.; Staiger, P.K.; Gold, L.; Johnson, B.; Macfarlane, S.; Long, C.; Townsend, M. Growing Community: The Impact of the Stephanie Alexander Kitchen Garden Program on the Social and Learning Environment in Primary Schools. *Health Educ. Behav.* **2012**, *39*, 419–432. [CrossRef] [PubMed]
19. Lohr, A.M.; Krause, K.C.; McClelland, J.; Van Gorden, N.; Gerald, L.B.; Del Casino, V., Jr.; Wilkinson-Lee, A.; Carvajal, S.C. The impact of school gardens on youth social and emotional learning: A scoping review. *J. Adv. Educ. Outdoor Learn.* **2020**, *21*, 371–384. [CrossRef]
20. Williams, D.R.; Dixon, P.S. Impact of Garden-Based Learning on Academic Outcomes in Schools: Synthesis of Research between 1990 and 2010. *Rev. Educ. Res.* **2013**, *83*, 211–235. [CrossRef]
21. Jaenke, R.L.; Collins, C.E.; Morgan, P.J.; Lubans, D.R.; Saunders, K.L.; Warren, J.M. The Impact of a School Garden and Cooking Program on Boys' and Girls' Fruit and Vegetable Preferences, Taste Rating, and Intake. *Health Educ. Behav.* **2012**, *39*, 131–141. [CrossRef] [PubMed]
22. Davis, J.N.; Spaniol, M.R.; Somerset, S. Sustenance and sustainability: Maximizing the impact of school gardens on health outcomes. *Public Health Nutr.* **2015**, *18*, 2358–2367. [CrossRef] [PubMed]
23. Ohly, H.; Gentry, S.; Wigglesworth, R.; Bethel, A.; Lovell, R.; Garside, R. A systematic review of the health and well-being impacts of school gardening: Synthesis of quantitative and qualitative evidence. *BMC Public Health* **2016**, *16*, 286. [CrossRef]
24. Kim, S.-O.; Park, S.-A. Garden-based integrated intervention for improving children's eating behavior for vegetables. *Int. J. Environ. Res. Public Health* **2020**, *17*, 1257. [CrossRef] [PubMed]
25. Qi, Y.; Hamzah, S.H.; Gu, E.; Wang, H.; Xi, Y.; Sun, M.; Rong, S.; Lin, Q. Is School Gardening Combined with Physical Activity Intervention Effective for Improving Childhood Obesity? A Systematic Review and Meta-Analysis. *Nutrients* **2021**, *13*, 2605. [CrossRef]
26. Rochira, A.; Tedesco, D.; Ubiali, A.; Fantini, M.P.; Gori, D. School Gardening Activities Aimed at Obesity Prevention Improve Body Mass Index and Waist Circumference Parameters in School-Aged Children: A Systematic Review and Meta-Analysis. *Child. Obes.* **2020**, *16*, 154–173. [CrossRef]
27. Heim, S.; Bauer, K.W.; Stang, J.; Ireland, M. Can a community-based intervention improve the home food environment? Parental perspectives of the influence of the delicious and nutritious garden. *J. Nutr. Educ. Behav.* **2011**, *43*, 130–134. [CrossRef] [PubMed]
28. Kirkland, L.; Apatu, E.; Mease, A.; Largo-Wight, E. School-based nutrition and garden programs and parental dietary changes in low-income settings: A review. *Int. J. Health Promot. Educ.* **2018**, *56*, 226–236. [CrossRef]
29. Carlsson, L.; Williams, P.L.; Hayes-Conroy, J.; Lordly, D.; Callaghan, E. School Gardens: Cultivating Food Security in Nova Scotia Public Schools? *Can. J. Diet. Pract. Res.* **2016**, *77*, 119–124. [CrossRef] [PubMed]
30. Laurie, S.M.; Faber, M.; Maduna, M.M. Assessment of food gardens as nutrition tool in primary schools in South Africa. *S. Afr. J. Clin. Nutr.* **2017**, *30*, 80–86. [CrossRef]
31. Eugenio-Gozalbo, M.; Ramos-Truchero, G.; Suárez-López, R. University gardens for sustainable citizenship: Assessing the impacts of garden-based learning on environmental and food education at Spanish Higher Education. *Int. J. Sustain. High. Educ.* **2021**, *22*, 516–534. [CrossRef]
32. Eugenio, M.; Zuazagoitia, D.; Ruiz-Baltar, A. Huertos EcoDidácticos y Educación para la Sostenibilidad. Experiencias educativas para el desarrollo de competencias del profesorado en formación inicial [Organic Learning Gardens and Education for Sustainability. Educational experiences for competencies development in pre-service teacher training]. *Rev. Eureka Sobre Enseñanza Divulg. Cienc.* **2018**, *15*, 1501. [CrossRef]
33. Cheang, C.C.; So, W.-M.W.; Zhan, Y.; Tsoi, K.H. Education for sustainability using a campus eco-garden as a learning environment. *Int. J. Sustain. High. Educ.* **2017**, *18*, 242–262. [CrossRef]
34. Duram, L.A.; Williams, L.L. Growing a student organic garden within the context of university sustainability initiatives. *Int. J. Sustain. High. Educ.* **2015**, *16*, 3–15. [CrossRef]
35. LaCharite, K. Re-visioning agriculture in higher education: The role of campus agriculture initiatives in sustainability education. *Agric. Hum. Values* **2016**, *33*, 521–535. [CrossRef]

36. Barlett, P.F. Campus sustainable food projects: Critique and engagement. *Am. Anthropol.* **2011**, *113*, 101–115. [CrossRef]
37. Galt, R.E.; Clark, S.F.; Parr, D. Engaging values in sustainable agriculture and food systems education: Toward an explicitly values-based pedagogical approach. *J. Agric. Food Syst. Community Dev.* **2012**, *2*, 43–54. [CrossRef]
38. Real Decreto 1105/2014, de 26 de diciembre, por el que se establece el currículo básico de la Educación Secundaria Obligatoria y del Bachillerato. *Boletín Of. del Estado* **2015**, *3*, 169.
39. Gilbert, J.K.; Bulte, A.M.W.; Pilot, A. Concept Development and Transfer in Context-Based Science Education. *Int. J. Sci. Educ.* **2010**, *33*, 817–837. [CrossRef]
40. Laugksch, R.C. Scientific literacy: A conceptual overview. *Sci. Educ.* **2000**, *84*, 71–94. [CrossRef]
41. Georghiades, P. Beyond conceptual change learning in science education: Focusing on transfer, durability and metacognition. *Educ. Res.* **2000**, *42*, 119–139. [CrossRef]
42. Osborne, J.; Dillon, J. *Science Education in Europe: Critical Reflections*; Nuffield Foundation: London, UK, 2008.
43. Guisasola, J.; Oliva, J.M. Nueva sección especial de REurEDC sobre investigación basada en el diseño de secuencias de enseñanza. *Rev. Eureka Sobre Enseñanza Divulg. Cienc.* **2020**, *17*, 3001. [CrossRef]
44. Artigue, M. Didactic Engineering. *Rech. Didact. Mathématiques* **1992**, *13*, 41–66.
45. Giné, N.; Parcerisa, A. Fases de la secuencia formativa. In *Planificación y Análisis de la Práctica Educativa*; Giné, N., Parcerissa, A., Eds.; Graó: Barcelona, Spain, 2003; pp. 35–45.
46. Zabala, A.; Arnau, L. Los métodos para la enseñanza de las competencias deben tener un enfoque globalizador. In *11 Ideas Clave. Cómo Aprender y Enseñar Competencias*; Zabala, A., Arnau, L., Eds.; Graó: Barcelona, Spain, 2007; pp. 163–191.
47. Dobson, A. *Citizenship and the Environment*; Oxford University Press: Oxford, UK, 2003.
48. Andersson, B.; Bach, F.; Hagman, M.; Olander, C.; Wallin, A. Discussing a research programme for the improvement of science teaching. In *Research and the Quality of Science Education*; Boersma, K., Goedhart, M., de Jong, O., Eijkelhof, H., Eds.; Springer: Berlin/Heidelberg, Germany, 2005; pp. 221–230.
49. Cobb, P.; Confrey, J.; diSessa, A.; Lehrer, R.; Schauble, L. Design Experiments in Educational Research. *Educ. Res.* **2003**, *32*, 9–13. [CrossRef]
50. Guisasola, J.; Zuza, K.; Leniz, A. Designing Teaching Learning Sequences Based on Design-Based Research. Fundamental. In *Physics and Physics Education Research*; Sidharth, B.G., Carnicer Murillo, J., Michelini, M., Perea, C., Eds.; Springer: Berlin/Heidelberg, Germany, 2021; pp. 163–174. [CrossRef]
51. Roura Labiaga, A.; López García, M.; Merino Redondo, M.; Romero Arance, I.; Romero Rosales, M.; Sanz Esteban, M. Unit "Food & Nutrition". In *Inicia Biology & Geology. 3 Secondary*; Oxford University Press: Oxford, UK, 2015; pp. 23–35.
52. Miles, M.; Huberman, M.; Saldaña, J. *Qualitative Data Analysis: A Methods Sourcebook*, 3rd ed.; SAGE Publications Inc.: Thousand Oaks, CA, USA, 2014.
53. Valles Martínez, M.S. El reto de la calidad en la investigación social cualitativa de la retórica a los planteamientos de fondo y las propuestas técnicas. *Rev. Española Investig. Sociológicas (REIS)* **2005**, *110*, 91–116. [CrossRef]
54. Fritz, C.O.; Morris, P.E.; Richler, J.J. Effect size estimates: Current use, calculations, and interpretation. *J. Exp. Psychol. Gen.* **2012**, *141*, 2–18. [CrossRef]
55. Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed.; Erlbaum: Hillsdale, NJ, USA, 1988.
56. European Union (EU). Recommendation 2006/962/EC of the European Parliament and of the Council, of 18 December, on Key Competences for Lifelong Learning. Brussels. Available online: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006H0962&from=EN (accessed on 28 December 2021).
57. Real Decreto 126/2014, de 28 de febrero, por el que se establece el currículo básico de la Educación Primaria. *Boletín Of. del Estado* **2014**, *52*, 19349–19420.
58. Brocos, P.; Jiménez Aleixandre, M.P. El impacto ambiental de la alimentación: Argumentos de alumnado de Magisterio y Secundaria. *Enseñanza de las Ciencias* **2020**, *38*, 127–145. [CrossRef]
59. Annunziata, A.; Mariani, A.; Vecchio, R. Effectiveness of sustainability labels in guiding food choices: Analysis of visibility and understanding among young adults. *Sustain. Prod. Consum.* **2019**, *17*, 108–115. [CrossRef]
60. Román, S.; Sánchez-Siles, L.M.; Siegrist, M. The importance of food naturalness for consumers: Results of a systematic review. *Trends Food Sci. Technol.* **2017**, *67*, 44–57. [CrossRef]
61. Pearson, N.; Biddle, S.J.H. Sedentary Behavior and Dietary Intake in Children, Adolescents, and Adults: A systematic review. *Am. J. Prev. Med.* **2011**, *41*, 178–188. [CrossRef] [PubMed]
62. Burningham, K.; Venn, S. "Two quid, chicken and chips, done": Understanding what makes for young people's sense of living well in the city through the lens of fast food consumption. *Local Environ.* **2021**, *27*, 80–96. [CrossRef]
63. Fiszman, S.; Puerta, P.; Chaya, C.; Tarrega, A. The impact of COVID-19 lockdown on food priorities. Results from a preliminary study using social media and an online survey with Spanish consumers. *Food Qual. Prefer.* **2020**, *86*, 104028. [CrossRef]
64. Kaat, P.; Chabanet, C.; Issanchou, S.; Monnery-Patris, S. Child eating behaviours, parental feeding practices and food shopping motivations during the COVID-19 lockdown in France: (How) did they change. *Appetite* **2021**, *161*, 105132. [CrossRef]
65. Goldman, R.; Stephen, P. Advertising in the Age of Hypersignification. *Theory Cult. Soc.* **1994**, *11*, 23–54. [CrossRef]
66. Sánchez-Bravo, P.; Chambers, E.; Noguera-Artiaga, L.; López-Lluch, D.; Chambers, Á.; Carbonell-Barrachina, A.; Sendra, E. Consumers' Attitude towards Edgar the Sustainability of Diferent Food Categories. *Food* **2020**, *9*, 1608. [CrossRef]