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Proposing a Pedagogical Framework for Integrating Urban Agriculture as a Tool to Achieve Social Sustainability within the Interior Design Studio

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Abstract: Evidently, the global population is increasing. A decline in the stock of agricultural land per capita is becoming a global issue. The future agriculture output may need to grow in order to satisfy the future growing demands. Feeding the global population of 9.1 billion by the year 2050 requires growth in global agriculture output by approximately 60% to 110%. Urban agriculture as an alternative solution can reduce the future burden on agriculture sector. As a response to this issue, the interior architecture design studio-V (INT 401) proposes a futuristic vision which is based on the notion of urban agriculture. This vision requires a pedagogical framework to be defined for the interior design studio-V. The proposed pedagogy consists of the following three notions: (1) residential urban agriculture, (2) context-based and culture-based design approach, and (3) social sustainability. The proposed pedagogy follows a futuristic vision that advocates that future interior spaces and adjacent spaces should be capable of cultivating food. The proposed pedagogy tries to integrate the concept of residential urban agriculture within its core. The context-based and culture-based design approach highlights the importance of considering the local context during the design process. The interior design studio pedagogy should be valued, studied, and reflected in local traditions, practices, and values. The proposed pedagogy is based on the threefold schema of social sustainability that comprises development sustainability, bridge sustainability, and maintenance sustainability. The proposed design studio pedagogy highlights the following three points: (1) defining a vision for the interior design studio; (2) the interior design studio should be responsive to the contemporary and future social, environmental, and economic issues; and (3) the importance of considering the local context and reflecting it within the interior design studio pedagogy.

Keywords: residential urban agriculture; social sustainability; interior architecture; design studio pedagogy



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1. Introduction

The population of the globe continues to increase and it is evident that future population growth is inevitable. Currently, the globe is witnessing a decline in arable land. This decline on a global scale means that there will be a shortage of farmlands that is essential to feed the growing population. Due to the population growth, it is evident that the agriculture output needs to be enlarged in order to satisfy the future growing demands.

This research believes that one possible solution which can reduce the future burden on agriculture sector is urban agriculture. Large-scale food production can occur in future interior and exterior spaces (interior spaces, transitional spaces, balconies, windowsills, and rooftops) within dense urban fabrics. This research proposes that the interior design studios should be based on a pedagogy which is responsive to the contemporary and

future environmental and social issues. The interior design studio views interior spaces and spaces adjacent to it as grounds where food can be cultivated. By cultivating food in future interior and exterior spaces, the future burden on agricultural sector can be reduced.

The principal aim is to propose a pedagogy framework for the interior design studio-V (INT 401) in the Department of Interior Architecture at the Faculty of Architecture, Design, and Fine Arts at Girne American University in Cyprus. The INT 401 interior design studio-V is offered in the fourth year of the interior architecture program. The main focus of INT 401 is to incorporate the concepts of residential urban agriculture, the context-based and culture-based design approach, and social sustainability within the proposed studio pedagogy framework.

The interior design studio-V (INT 401) follows a futuristic vision. It is based on the notion that the future interior spaces, particularly the residential spaces in developing countries, should produce food. The proposed design studio pedagogy is limited to the interior design of residential buildings; therefore, the concept of urban agriculture within the studio framework is limited to residential urban agriculture. In this research, residential urban agriculture encompasses growing food in interior spaces and adjacent spaces, such as balconies, semi-open spaces, transitional spaces (entrance spaces), window sills, rooftops, and gardens. The practice of urban agriculture beyond the residential space, such as community gardens, is outside the scope of residential urban agriculture and the proposed pedagogy framework.

The proposed design studio pedagogy follows a context-based and culture-based design approach, meaning that interior architecture design proposals should be situated and adapted to their specific context and culture. The first aim of the context-based and culture-based design approach is to record the ways Cypriots arrange and maintain their edible gardens and their green decorative elements within their residential buildings in the Kyrenia district (Kyrenia and Lapta) located in Cyprus. The second aim of the context-based and culture-based design approach is to reflect the mentioned local practices within the interior design studio pedagogy. A design proposal that is not sensitive to the local context and culture can disrupt the established patterns of behavior, traditions, and values of local people. As a result, local people may actively resist engaging with the proposed design project [1].

The social aspect of sustainability is part of the studio pedagogy. The academic environment should equip young interior architects to face the real problems and challenges they will confront in the upcoming decades. Young interior architects, especially in developing countries, should be equipped to face challenges that future societies face, such as urban poverty, food insecurity, economic instability, and environmental degradation. In fact, to face the contemporary and future social and environmental challenges, major changes should be adopted to how young interior architects and architects are educated within the academic environment [2]. Integrating the concept of social sustainability within the interior design studio pedagogy can be considered as a response to contemporary and future social and environmental issues [3,4]. Successful integration of the sustainability concept, especially the social sustainability within the interior architecture and architecture studio pedagogies, can reduce reliance on fossil fuels and other non-renewable sources in the built environment. In addition, it enhances the individual's well-being and quality of life in relation to the local and global environment [4]. Therefore, the concept of sustainability should be embedded in the interior design studio pedagogy [3,5].

Sustainable architecture and interior architecture are generally perceived in both architecture and interior architecture disciplines as equivalent to designing energy-efficient buildings. Although designing energy-efficient buildings is a vital aspect and should be considered within the architecture and interior architecture pedagogy, it should not undermine the importance of social sustainability [6,7]. The sustainability concept should contain various aspects of human activity, including social, cultural, ethical, and aesthetic values, rather than solely focusing on responding to technical issues, such as energy

consumption, a reduction in CO₂ emissions, and resource management [6]. Therefore, the purpose of the INT 401 interior design studio pedagogy is to focus on social sustainability.

The contribution of this research to the discipline of interior architecture can be summarized and centered around a futuristic vision. It attempts to be responsive to the future demand regarding food production. In order to reduce the future burden on agriculture sector, this research proposes that interior and exterior spaces can be regarded as grounds where food can be cultivated. This research proposes the concept of residential urban agriculture and attempts to incorporate it within the interior design studio pedagogy. By implementing the concept of residential urban agriculture within the interior design studio, young interior architects learn that their design proposals have impact within a particular society; it can enhance the well-being and quality of life of people in a particular society. In addition to this concept, this research values the existing local practices and attempts to reflect it within the interior design studio.

This research aims to propose a pedagogy framework for the interior design studio and, by doing that, reaches the following three objectives: (1) to incorporate the concept of residential urban agriculture within the interior design studio pedagogy; (2) to promote the context-based and culture-based design approach within the interior design studio pedagogy (implementing it can raise the awareness of young interior architects regarding valuing and studying local practices, such as the ways Cypriots arrange and maintain their edible gardens and their green decorative elements within their residential buildings in Kyrenia district, and young interior architects can experience the process of reflecting these local practices within the interior design studio projects); and (3) to implement the concept of social sustainability within the interior design studio pedagogy.

2. Literature Review: Future Urban Growth and Urban Agriculture

Since 2009, for the first time in history, the total number of people living in urban areas (3.42 billion) has exceeded the total number of individuals dwelling in rural areas (3.41 billion). Since 1950, the world has been witnessing rapid urbanization; it is apparent that the world has become more urban than rural [8,9]. It is estimated that the globe's population will reach 8.5 billion by 2030 and 9.7 billion by 2050 [10–13]. It is estimated that the population of urban centers will reach 6.3 billion by the year 2050 [8,9]. It is projected that by 2030, roughly 60% of the world's inhabitants will reside in cities. By the year 2050, it is projected that 68 percent of the global population will dwell in urban centers [9,14–16]. It is predicted that most population growth will be concentrated in congested urban centers, particularly in major cities and towns in developing countries. According to the mentioned statistics and projections, it is evident that current and future urban growth is inevitable [17,18] (Figures 1 and 2).

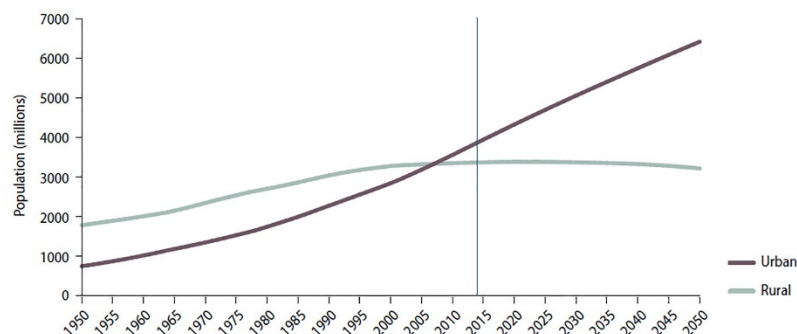


Figure 1. Urban and rural populations of the world, 1950–2050 [9].

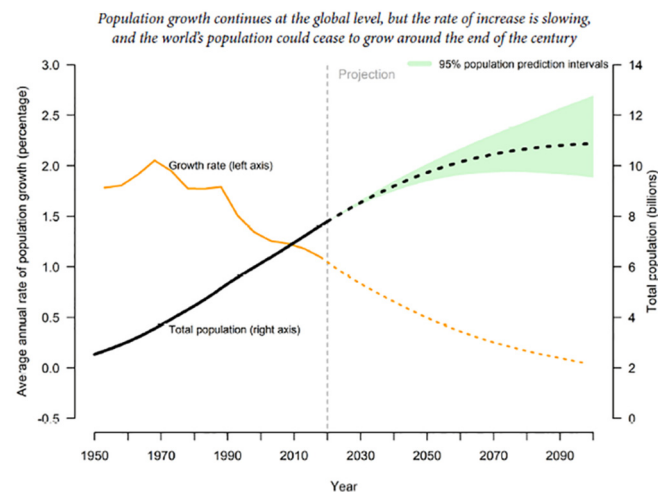


Figure 2. Population size and annual growth rate for the world: estimates, 1950–2020, and medium-variant projection with 95 per cent prediction intervals, 2020–2100 [12].

The prolonged decrease in agricultural land stock per capita is becoming an evolving global issue. The global arable land (hectares per person) has nearly declined by half from 0.361 in 1961 to 0.184 in 2018. It is projected that by 2050, the amount of available cultivable land per person will decrease to one-third of the amount available in 1970 [19,20] (Figure 3). The decline in arable land per person in Cyprus from 1961 to 2018 also matches the global pattern. The percentage of arable land has dropped from 35.6% of land area in 1961 to 11.3% of land area in 2018 [21] (Figure 4). This decline is estimated to continue due to population growth, urban growth, effects of climate change, scarcity of fresh water sources, soil depletion and degradation, desertification, over-farming, and poor agricultural practices. The decline in global arable land means that there will be a shortage of farmlands that is crucial to feed the growing population [20,22–25]. Population experts predict that approximately 2 to 4 billion people will be added to the global population within the next 3 to 4 decades [10,13,22,26]. Despite population growth, the available arable land continues to decline due to the mentioned issues [22].

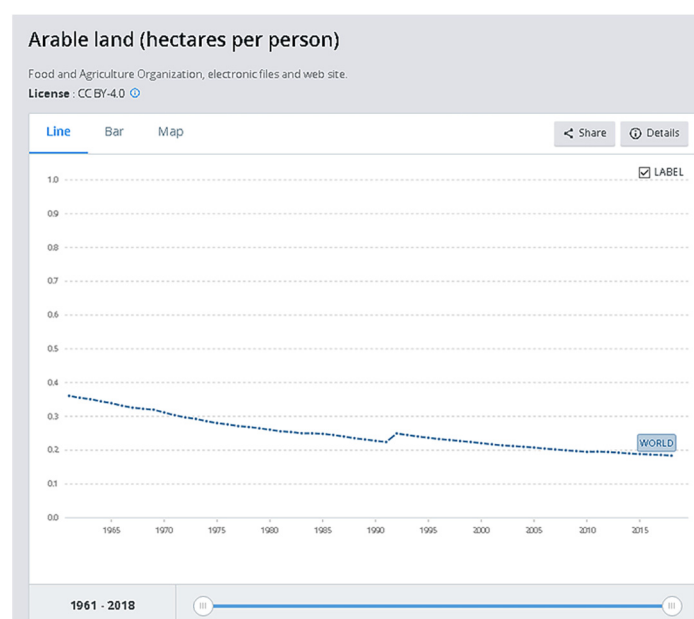


Figure 3. Decline in global arable land between 1961 and 2018 [27].

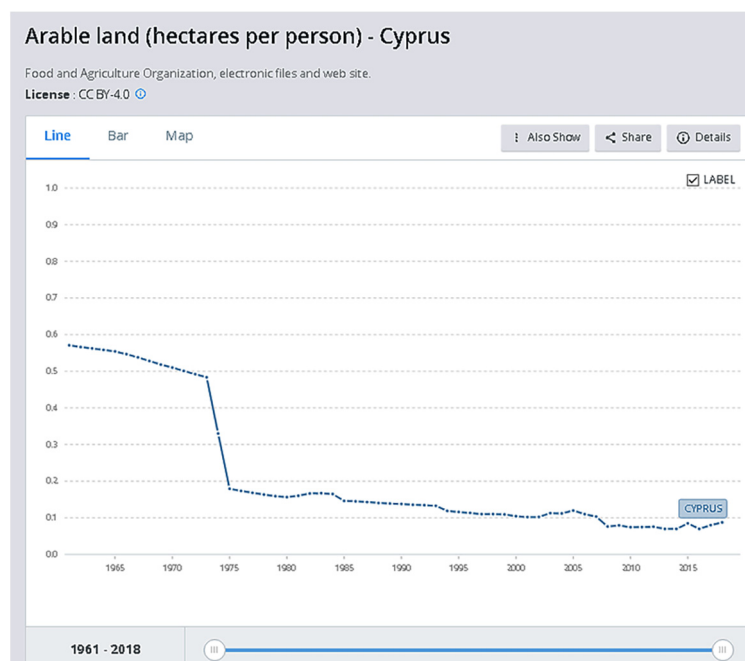


Figure 4. Decline in arable land in Cyprus between 1961 and 2018 [28].

Currently, there is a rising demand for crop production. It is projected that by 2050, the global agriculture output may need to grow by 60% to 110% to satisfy the growing demands [27,29–32]. Due to future population growth, there will be a demand for more crop production [24]. It is estimated that feeding the global population of 9.1 billion in the year 2050 demands an increase in the total food production of approximately 70 percent between 2005 to 2050 [33]. In fact, to feed a more populated world by the year 2050, the agriculture production needs to be doubled, which means the crop production needs to achieve a 2.4% growth per year. The current agriculture yields are no longer increasing in various regions of the globe. In fact, the present yield growth tendencies are simply inadequate to keep up with the rising demands. Meeting the future crop production goals arguably represents a challenge for future societies [24,29]. One of the major issues of the twenty-first century can be the conversion to more sustainable agriculture practices, doubling the amount of food production and facing the negative impact of climate change on agriculture productivity [24,30,31].

This research suggests that the notion of food production should not be regarded exclusively as a rural activity. One alternative solution that can reduce the agricultural sector's future burden is urban agriculture. Urban agriculture has been practiced in various cities in the global south, and it is reappearing in various cities with sustainability agenda in the global north. In this regard, architects and urban designers imagine contemporary and future cities as urban farms [34].

The innovative forms of urban agriculture can provide new landscape opportunities for large-scale food production and take pressure off the agricultural lands. In this vision, food can be produced in large quantities and on buildings in high-density urban centers. Future interior and exterior spaces in high-density urban environments can produce food on a large scale. Interior spaces, transitional spaces, balconies, and rooftops are ideal grounds that can be utilized for food production. In a world where population growth and urbanization are inevitable, urban agriculture can produce local fresh food within the cities. Urban agriculture can be considered a crucial aspect of sustainable future cities [26,35]. A sustainable city is an edible city that can host a continuous productive urban landscape [36]. A sustainable city can produce and deliver local fresh food to a large proportion of urban dwellers, especially low-income people with limited access to fresh food [35,37,38].

Urban agriculture contains economic, social, and environmental benefits, highlighted as follows. In terms of economic benefits, urban agriculture can contribute to food security and economic security. It can offset food expenditures, add to the family income, and generate jobs [26,35,39,40]. Food insecurity or the lack of access to both quantity and quality of food available to specific urban dwellers, especially low-income families, is a critical challenge in both developing and developed countries. Urban agriculture can enhance the quality and quantity of food accessible for specific urban groups, such as low-income urban dwellers. It can be considered a food security strategy for disadvantaged urban groups [18,35,41–44]. Urban agriculture can be utilized as an additional source of income and can play a crucial role in eradicating poverty and hunger in urban areas [38,39,41,45].

Urban agriculture can have social benefits. Urban agriculture can foster community empowerment via educational programs, such as skills development or job training, benefiting low-income urban dwellers residing in underserved areas. In this way, it serves social justice [38,39]. Urban agriculture can contribute to civic engagement. Urban agriculture practitioners are more likely to volunteer in their communities and are politically more engaged [46–48]. Community gardens and rooftop gardens are places where individuals can meet and socialize [46,49,50].

Urban agriculture also benefits the environment of a city by greening the city, providing habitat for wildlife, lowering the urban heat island effects, recycling the urban waste, and reducing the energy embodied in food transportation [26,35,37,39,43]. Urban agriculture can shorten the distance from food producers and consumers, lower transportation distance, reduce transportation costs, and lower harmful environmental emissions [25–27,35,39,51].

2.1. Integrating Social Sustainability in the Interior Design Studio

Sustainable development can be considered a development paradigm; it received wide-range attention, while other existing concepts lack such attention and popularity. It seems that sustainable development will remain the prevalent development paradigm for an extended period of time [52–54]. Sustainable development should not be considered a contemporary concept. The notion of development or progress is intertwined with human civilization. The idea of progress can be seen throughout history in various eras. As development and progress, sustainability should also be regarded as a historical notion. From ancient civilizations to the postmodern era, the notion of sustainability is evident in different philosophical, social, and economic contexts [55].

The notion of development has been defined and interpreted by various scholars. Development can be defined as evolutionary progress in which the human ability enhances in managing new issues, establishing new goals, and adapting to constant changes [52,55]. In another definition, development is seen as a social condition in which the demand of a specific group of people is satisfied by the sustainable utilization of available natural resources [52,56]. The sustainability phase can be explained as the ability to maintain some entity, process, or outcome over an extended period of time [52,57,58]. Sustainability is regarded as a concept within the development literature with the goals to enhance and maintain human development's economic, social systems, and ecology [52]. Sustainable development can literally be defined as development that can proceed at a specific time period or permanently [52].

The discourse of sustainable development became prominent by the middle of the twentieth century. By the late 1960s and the beginning of the 1970s, the idea of unlimited economic growth and continuous progress lost its appeal and was considered an illusion or fiction. During this era, it was realized that the notion of continuous progress justified the exploitation of natural resources, which caused irreversible damage to the natural environment. This realization paved the way for the emergence of the sustainable development concept in the 70s [52,55].

The United Nations Conference on the Human Environment, organized in Stockholm in 1972, resulted in the introduction of sustainable development and international

recognition of sustainable development [58,59]. Afterward, the World Commission on Environment and Development (WCED), which is known as the Brundtland Commission, published their report entitled “Our common future” [60]. Sustainable development in this report is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [60] (p. 41). The most cited definition of sustainable development is suggested by this report [52,55,58,61]. The Brundtland Report argues that the concept of sustainable development can respond to contemporary and future social, environmental, and economic challenges [58,60]. The Brundtland Report suggests that economic growth, environmental preservation/restoration, and social equity can be simultaneously attained. This report proposes that sustainability contains the following three spheres: environment, economy, and society [52,55,60]. These three spheres contain a series of interrelated notions, and it is suggested that future decisions and actions should be based on them [52].

The three bottom-line concept describes the relationship between the three spheres. The three spheres of sustainability must be in mutual balance to achieve sustainability. Creating a balance among the three spheres is not an easy task since each sphere must respect the interests of other spheres not to cause imbalance. It is possible that while one of the spheres becomes sustainable, other spheres become unsustainable [58,62]. It should be mentioned that the sustainable development concept received criticisms from the beginning. In essence, the concept is still under progress and demands further refinements [52,55]. Despite recent critiques and revisions within the classic model of sustainability and its three bottom-line concepts, social sustainability has been recognized as a valid and integral component of sustainable development [63].

In general, social sustainability has been considered as the least conceptually developed pillar of sustainable development. Although social sustainability is under-theorized and under-developed, it is regarded as a valid pillar in sustainable development discourse [7,63–67]. The lack of a conceptual framework or concrete definition for social sustainability should not be regarded as a disadvantage. Rather, it mirrors the complexity of the social aspect of sustainability. It provides a foundation for the researchers to develop place-specific and case-specific frameworks [63].

Social sustainability can be considered a bedrock that can be based on environmental sustainability. The social sphere facilitates the foundation for individuals to define their perception and relation towards the natural world. Environmental sustainability cannot be achieved without a shift in the way humans relate to nature [68]. Social sustainability aims to explore ways to improve the individual’s well-being and quality of life, which establishes practical legacies to shape the individual’s perception and attitude towards nature [69,70]. Furthermore, social sustainability can be considered as a condition and process that can enhance a community’s well-being and quality of life in the present and future [67].

It should be mentioned that the social aspect of sustainability has been given little attention within the discipline of the built environment, particularly the field of interior architecture. Social sustainability focuses on the human aspect of sustainable development. Its goal is to improve the well-being and quality of life of individuals. The design and construction of the interior spaces cannot be separated from their impact on their users. The design of interior spaces should not be regarded as solely focusing on creating physical spaces. Interior spaces can form the way people and their environment interact with each other. The environment that people dwell and experience in their everyday lives can enhance their well-being and quality of life [7,71].

Social sustainability can be considered the ability of people and society’s lifestyle, traditions, and culture to continue to satisfy their current demands and those of the next generations. Social sustainability identifies that the built environment and its design enable experiences and relationships central to the users [71]. The interior environments should satisfy the user’s values, everyday activities, and current and future needs.

The proposed interior design studio framework is intertwined with the following three aspects of social sustainability: development sustainability, bridge sustainability,

and maintenance sustainability. Development sustainability encompasses concerns for a wide spectrum of issues, such as satisfying basic needs of individuals in a particular society, including access to healthy food to other issues (education, employment, equity, and justice). Development sustainability argues that individuals start to actively address environmental issues when their basic needs are satisfied [1]. It is unrealistic to anticipate that individuals in society show concerns regarding global warming, environmental degradation, deforestation, or extinction of species when unemployed, homeless, and hungry [66,72]. Practicing urban agriculture at the residential scale and social sustainability shares the following similar outcomes: enhancing access to an affordable and nutritious diet which can ensure that one of the basic needs of the individuals in a society is satisfied. Residential urban agriculture can create jobs and generate additional income by selling surplus products. By creating jobs, the quality of life and well-being of individuals in a society can be enhanced [73].

Bridge sustainability is concerned with exploring ways to promote eco-friendly behavior. The principal goal is to identify the social condition, which is crucial and fundamental to supporting ecological sustainability. The social condition can range from a transformative approach to a non-transformative approach regarding the individual's relation with the environment. The transformative approach aims to challenge and re-imagine new ways that people relate to the environment. On the other hand, the non-transformative approach encourages small incremental changes without requiring substantial shifts in how individuals relate to the environment [1]. Encouraging urban dwellers to engage in home-based edible gardens to grow fresh food can be considered a non-transformative approach [74–76]. The non-transformative approach believes that new technological innovations can be adapted and utilized without demanding change in the lifestyle of the individuals in a society [1].

Considering the context of Kyrenia and Cyprus, the proposed studio framework applies a non-transformative approach. The field work results in local Cypriot houses in the Kyrenia district demonstrate a strong bond between Cypriots and their edible landscapes. The practice of planting and growing vegetables and fruits is popular among Cypriots. Furthermore, sharing vegetables and fruits with friends and family members is another common practice between Cypriots.

The proposed studio framework encourages young interior architects to study local lifestyles and practices and reflect them within their design studio projects. Moreover, the proposed studio framework encourages young interior architects to integrate innovative food production approaches such as hydroponic systems with grow lights or vertical farming within their design projects. The future urban dwellers, especially low-income people, are empowered to cultivate high-quality fresh food with minimum consumption of resources in their residential homes. In this way, their quality of life and well-being can be improved [27].

Maintenance sustainability focuses on practices, traditions, preferences, and places that people are interested in sustaining and improving. Vernacular traditions and practices in a particular society can be considered a foundation on which people's social networks, leisure opportunities, and living spaces are based. The maintenance of social sustainability is primarily focused on the ways social and cultural traditions and practices with regard to the environment are sustained over time [1]. Field work results demonstrate that local Cypriots residing in the Kyrenia district are interested in maintaining their practice of growing food in their residential edible gardens. The proposed studio pedagogy recognizes and values local practices and encourages young interior architects to integrate them into their design projects.

Within the social sustainability discourse, eco-friendly proposals and frameworks can fail to operate if their implementation within a particular society disrupts local people's established traditions and patterns of behavior. In fact, local people may actively resist changing their established way of life if they do not relate to the eco-friendly proposals [1]. For any eco-friendly proposal, to be socially sustainable, it should receive widespread

social acceptance within a particular society [77]. A successful eco-friendly proposal should reflect a self-conscious culture that actively observes social issues and generates locally informed responses [78].

2.2. Residential Urban Agriculture

Urban agriculture is generally defined as cultivating food within (intra-urban) or on a city's urban fringe (peri-urban). Considering peri-urban agriculture as urban agriculture is still a subject under debate. Some researchers limit their definition of urban agriculture to solely cultivating food within the city's boundary. Researchers regard urban agriculture as food and livestock production within the urban fabric [40,46,79]. Other researchers consider urban agriculture to cultivate food and raise livestock both in the urban fabric and peri-urban areas [26,43,46,49,80–86]. Urban agriculture involves producing, processing, and distributing cultivated or raised food products, such as crops and livestock [81]. Urban agriculture can be practiced in balconies, window sills, backyards, rooftops, community gardens, available vacant lots, public spaces, and vacant public lands [85,87,88]. It can be practiced in open spaces or build-up sites, such as residential, industrial, or commercial buildings. The production scale can vary from small-scale enterprises for self-consumption purposes to large-scale commercial productions for market-oriented purposes [81]. Urban agriculture usually focuses on cultivating high-value and perishable products such as leafy vegetables, mushrooms, and herbs grown in small spaces. The production of eggs, poultry, pigs, and fish can also be considered part of the practice [85]. As mentioned before, in this research, residential urban agriculture encompasses cultivating food in interior spaces and spaces adjacent to it. The practice of urban agriculture beyond the residential boundary is outside the scope of this research.

Due to the high land cost and scarce land availability in urban centers, various agricultural strategies and production are proposed in several cities worldwide. These include shifting to above ground, building-borne systems (such as interior spaces, windowsills, balconies, and rooftops), and utilizing non-soil-based production systems (such as hydroponics and containers) [89].

Interior spaces are potential spaces for growing food. Indoor zones that receive direct sunlight, such as window sills, beneath a skylight, or bright rooms, are potential spaces for growing food. South-, east-, and west-facing windows and below skylights are exposed to the maximum amount of natural sunlight for much of the day, especially during spring and summer. Indoor spaces that do not receive direct sunlight, such as basements, can be converted to small-scale indoor farming by utilizing grow lights. These spaces enable the household to cultivate various crops since they are exposed to many hours of bright light during the peak growing period in spring and summer. Edible crops such as herbs, edible flowers, sprouts, roots, leaves, and vegetables can be grown in containers in indoor spaces [90].

Hydroponic systems equipped with grow lights can be incorporated within the interior spaces to cultivate food. Individuals living in flats without outdoor gardens can increase their gardening options by utilizing hydroponic systems in their interior spaces [91]. The hydroponic system is a soilless system. The plants are in direct contact with the nutrient solution without any solid phase. The plant's roots are either directly put in the nutrient solution or suspended in a medium, e.g., perlite or rock wool. Hydroponic systems are closed systems, which means the entire drainage is recycled and circulates [20,26,92].

Hydroponic systems are advantageous in the sense that it is feasible to cultivate vegetables of good quality through an exact dosage of nutrients. Leafy vegetables (celery, lettuce, basil, and swiss chard), roots (beet, radish, turnip, and carrot), vine crops (cucumber, tomato, squash, pepper, zucchini, and beans), bulbs and tubers (garlic, onion, and potato), stems (asparagus and kohlrabi), culinary herbs (parsley, chives, and coriander), and aromatic and medicinal plants can be grown in hydroponic systems [92,93]. Water, fertilizers, and nutrients are used more effectively than conventional soil-based systems [25,91,92]. Hydroponic systems minimize the fertilizer's leakage into the environment. Hydroponic

systems require substantially less water than traditional cultivation methods and make farming in regions with water scarcity a more viable option. Yield per unit of the cultivated area is usually improved compared to conventional soil-grown systems, based on increased plant density and productivity [92]. Hydroponic systems can extend the growing season [91]. In densely built-up urban areas, where space availability usually limits production, lowspace technologies such as hydroponic systems can be utilized for space-confined growing [35,91]. Basements, interior spaces, balconies, and rooftops can be exploited for growing food. Nutritive crops can be grown in mentioned spaces which are beneficial for a wholesome diet [92].

Types of hydroponic systems installed in interior spaces are as follows: bottle hydroponics, floating raft, wicking bed, nutrient film technique, top drip system, media beds, and aeroponics [91]. The nutrient film technique allows for maximum efficiency in space usage. The lightweight nature of the nutrient film technique allows for vertical expansion. It is ideal for interior spaces such as basements and rooftop installation. The system consists of a frame structure with three to four levels. Channels are positioned on each level. Grow lights are installed on top of the channels. The system can host approximately 200 plants per cubic meter. In this way, the residential unit can host a small-scale vertical farm with artificial lighting [27,94,95].

South-, east-, and west-facing windows are ideal for cultivating crops. A window box can be installed on or near a window sill, both indoor and outdoor. A traditional window box is usually installed outside, below the window. During the winter months, the window boxes should be moved to a protected environment such as indoors or a greenhouse. An indoor window box should be proper drainage and a water collection tray. A window box can be suspended from the ceiling adjacent to the window. Usually, plants require between 2 to 6 h of direct sunlight per day. Depending on plant types and the amount of sunlight requirement, the window boxes can be put beside the properly oriented windows, such as the south-, east-, west-, and north-facing windows [90,96]. Suspended shelves can be installed beside the windows; in this way, the windows' full length can be utilized for growing crops. Wall shelves can be installed near south-, east-, or west-facing windows. Wall shelves occupy little space in a room and can be utilized to grow crops. LED or fluorescent grow lights can be added to shelves in dark corners to boost plant growth [90,97].

Balconies can be considered as spaces which have the potential of growing food. The preferable direction for balconies regarding sunlight is south, south-east, and south-west. Containers and pots should be located where they receive the maximum daylight; shaded spots should also be avoided. Windscreens can be installed to protect the plants from severe winds. Balcony floors, railings, and adjacent walls are ideal spaces for setting up the edible garden. Containers of various sizes can be arranged on the balcony floor. Balcony railing planters can be installed along the railings. Railing planters are exposed to daylight, and they hang off the balcony. In balconies where space is limited, suspended baskets can be installed to maximize the amount of growing space. Suspended baskets can be hung from the balcony ceiling, adjacent walls, or the balustrades [97,98].

Living walls can be installed on the south-, east-, and west-facing building envelopes. A living wall can be defined as a self-sufficient vertical garden that is installed on building elevations. A living wall consists of a supporting structure that is fixed to the building elevation and containers, vertical modules, pre-vegetated wall panels, or planter boxes filled with soil-based substrate attached to the supporting structure. A living wall includes a built-in watering system to automate the irrigation. All the necessary nutrients are delivered through the irrigation system. Individuals with limited gardening space can cultivate crops by installing the living wall system on their building elevations. A living wall can be installed in a narrow and small space (30 to 60 cm in width and 15 cm in depth). By stacking the containers on top of each other, more yield can be achieved in a smaller footprint [95,97,99,100].

Contemporary urban rooftops are mainly wasted space [35]. Flat roofs inside the dense urban fabric of the cities can be considered as potential spaces for cultivating food and practicing urban farming [51,89]. The rooftops usually have more exposure to solar energy than the ground below, making them ideal spaces for cultivating plants. The potential challenges for practicing rooftop urban agriculture include the following: preventive local policies and building codes, accessibility to the roof, imposing additional load on the building's structure, utility hook-ups, water leakage, and potential damage to the roof's insulation layers [101]. Despite these challenges, residential rooftops can be utilized to grow plants by installing soil-based or hydroponic systems [92,95].

Soil-based systems such as rooftop container gardens enable the cultivation of various crops with high intensity levels. Rooftop container gardens consist of containers of various materials and sizes. A variety of plants can be grown in containers. The majority of existing rooftops are not equipped with built-in irrigation systems. Irrigation systems such as micro-sprinklers or drip lines can be added to the rooftops [92,97]. Hydroponic systems also can be added to the rooftops [101].

Greenhouse structures can be incorporated onto the building rooftops [35,102]. The main function is to protect the crops against harsh conditions, including unfavorable temperature, wind, rain, diseases, and pests. The following points should be considered for designing rooftop greenhouses: rooftop greenhouses should permit maximum natural light transmission. The greenhouse location, orientation, covering material, and the structural system should be considered for maximum light transmission. The greenhouse location should be selected considering the neighboring building's shadow and the shadow of the mechanical types of equipment installed on the roof. In the Mediterranean region, including Cyprus, the preferable orientation is East to West. North to South orientation is not recommended for Cyprus [102].

The greenhouse can host hydroponic systems. Racks of crops can be installed on top of each other vertically. In this way, the amount of cultivated area can be increased. The vertical expansion in multi-rack systems can contribute to higher production volumes. All-year-round crop production can be achieved in a controlled environment, such as a greenhouse. Maximum yield can be achieved by optimizing the plant-growing conditions, such as controlling humidity and air temperature and providing 24 h LED lighting. The greenhouse can provide effective isolation from harsh external climate and reduce the need for pesticides, fertilizers, and herbicides [20,26,51].

A greenhouse can be attached to the elevation of a building. An attached greenhouse can be categorized as a lean-to, even-span, or window-mounted greenhouse. A lean-to greenhouse is basically a half greenhouse that is split along the roof's peak. It can be utilized where available space is limited. An even-span greenhouse is a full-size greenhouse that is attached to a building. It provides more growing space than the lean-to prototype. A window-mounted greenhouse can be installed on a window; the ideal location is the building's south or east side. It extends approximately 30 cm outward from the window. It can contain two or three shelves. The south, south-east, or east side is the preferable side for attaching the mentioned greenhouses to a building. The greenhouse should be accessible for people, and utilities such as water and electricity should be supplied. Automatic control can maintain the greenhouse environment by controlling the heating, cooling, ventilation, and lighting [103,104].

3. Methodology: Context-Based and Culture-Based Design Approach

The context-based and culture-based design approach is part of the proposed interior design studio pedagogy, based on the interpretative paradigm. The interpretative paradigm should be defined to ontology and epistemology. Interpretivism's relation to ontology is based on the following notion: knowledge and truth are subjective. Knowledge and truth are historically and culturally grounded, and it depends on people's experiences and comprehension [105,106]. In fact, truth is perceived by people as individuals [105]. Various truths and realities exist since each individual perceives truth and reality in a

unique way [106–108]. Concerning epistemology, interpretivism argues that individuals acquire various understandings and perceptions regarding the same phenomenon. This notion leads to the conception that individual differences should be considered valid. The interpretative paradigm recognizes various lifestyles, preferences, values, and cultures of individuals who dwell, comprehend, and perceive the built environment differently [105]. Interpretivism considers cultural context crucial and argues that cultural context cannot be neglected or removed from the research process. Individuals' perceptions, attitudes, and beliefs, as well as how they relate to their built environment, are within the scope of interpretivism research [108].

Ethnography can be considered a school of thought in an interpretative paradigm [108,109]. Ethnography studies individuals in their cultural context. It describes people and how they behave within the culture or subculture to which they belong and inhabit [108,110]. Ethnography provides qualitative descriptions regarding how a group of people in a specific context perceive and dwell within their built environment [105]. The principal aim is to focus on an ethnographic analysis of everyday practices and spatial organization within the domestic sphere in a specific context [111].

Culture is the sum of collective values and beliefs that local people live by. The discipline of ethnography does not regard culture as a fixed or concrete entity. Rather, it is perceived as a context within which local people engage with the complexities of their everyday life. Local people's behavior and actions form cultural forms. The discipline of ethnography tries to understand the culture within its specific context by providing an emic perspective. The emic perspective describes the reality as seen, experienced, perceived, and expressed by the local people in their cultural context [108,112].

The context-based and culture-based design approach is sensitive to a specific cultural context, as well as existing practices, traditions, and values. Without considering the local context, architects and interior architects are vulnerable to ethnocentric design. In this way, the final delivered project might be a good fit for the interior architect's circle, but a bad fit for the target society. If the final project is not designed considering the local context, the local community might reject it since locals are unable to cope with it or comprehend it. A context-sensitive project can contribute to the well-being of the users and thereby satisfies the principal goals of social sustainability [113]. The final project is meant to be delivered to the local people to be seen, perceived, and then utilized. In this regard, understanding the lifestyle, traditions, and values of local people is crucial to delivering successful design projects [105].

- This research is based on the after-mentioned three research questions. Research question one: How can the concept of residential urban agriculture influence the interior design studio pedagogy?
- Research question two: How are the concepts of social sustainability and residential urban agriculture embedded with the interior design studio learning outcomes?
- Research question three: How can Cypriots arrange and maintain their edible gardens and green decorative elements within their residential buildings in the Kyrenia district, and how can such local practices be integrated within the interior design studio?

This research comprises the four following phases. In phase one, a literature review is conducted. As part of the literature review, future urban growth and urban agriculture, social sustainability in the interior design studio, and residential urban agriculture are covered as principal topics. Phase two consists of data collection which is explained in detail in Section 3.1. Phase three consists of incorporating the concept of residential urban agriculture, the context-based and culture-based design approach, and social sustainability within the interior design studio. Phase four consists of a pedagogical framework definition and application within the interior design studio (see Table 1).

Table 1. Steps taken for conducting this research.

Phase one: literature review
<ul style="list-style-type: none"> • Conducting a literature review covering the following topics: (1) future urban growth and urban agriculture, (2) social sustainability in interior design studio, and (3) residential urban agriculture
Phase two: data collection
<ul style="list-style-type: none"> • Data collection methodology: qualitative data collection, conducting field works. • Aim of the field works: to record how local Cypriots in the Kyrenia district arrange and maintain their decorative green elements and their edible gardens within their residential homes. • Data collection methods: participant observation, observational sketching, and unstructured interviews.
Phase three: incorporating the bellow concepts within the interior design studio
<ul style="list-style-type: none"> • Incorporating the concept of residential urban agriculture within the interior design studio. • Incorporating the context-based and culture-based design approach within the interior design studio. • Incorporating the social sustainability concept within the interior design studio.
Phase four: pedagogical framework definition and application within the interior design studio
<ul style="list-style-type: none"> • Aims to define a pedagogical framework definition based on the mentioned concepts in phase three. • Aims to apply the framework within the interior design studio (INT 401).

3.1. Data Collection

Individuals spend most of their time in built environments that usually last longer than other artifacts. If the goal of interior architecture and architecture is fundamentally about the user's well-being, then collecting data by utilizing the ethnographic lens regarding the users as social and cultural beings is crucial for both interior architects and architects. Ethnographic methods of data collection can assist the interior architect in studying the way local people use and interact with their domestic environments [111]. As mentioned before, the context-based and culture-based design approach focuses on the ways Cypriots arrange and maintain their edible gardens and their green decorative elements within their residential buildings. The following data collection methodology has been applied to study the Cypriot residential homes and collect data.

This research is based on qualitative methods for data gathering [114]. To gather data, various field works were conducted in the Kyrenia district (Kyrenia and Lapta) during the spring and summer of 2021. The field works' principal aim was to record how local Cypriots in the Kyrenia district arrange and maintain their green decorative elements and their edible gardens within their residential houses. The typology of residential buildings selected as case studies included the following: (1) detached villas and semi-detached villas, (2) row houses, and (3) apartment buildings. For each selected case study residential building, the following spaces are studied: doorways, window sills, balconies, external walls, rooftops, gardens, and garden walls.

During the field works, participant observation, observational sketching techniques, and unstructured interviews were used as data collection methods. A participant observation technique was used to record how local people arrange and maintain their green decorative elements and edible gardens within their residential buildings. Each case study residential building visited, observed, and observed data recorded in the field notes. Each selected case study residential building was photographed to create an inventory of visual data.

This research utilized an in situ observational sketching technique which is the practice of sketching on location to record the existing context. In architecture, observational sketching has been used as an effective tool for studying and analyzing the built environment [115,116]. Observational sketching empowers the researchers to consciously select which specific data to draw and illustrate. In this regard, observational sketching provides a partial and tentative representation of the observed phenomenon. The researcher can focus on small details by utilizing observational sketching and can only select and illustrate the vital data. In fact, the researcher is not obliged to draw everything within the field of vision. Observational sketching requires concentration and paying attention to details. It requires selecting and illustrating crucial data, while other data collection methods, such as participant observation, might overlook such crucial details [115]. The practice of observational drawing during the fieldwork required the researcher as an observer to spend time within a particular location. In this context, observational drawing is durational, as it takes place over time [117]. Observational sketching was utilized to illustrate how local people arrange their green decorative elements and edible gardens within their residential buildings. Unstructured interviews were used to elicit data from the research participants as informants. Local Cypriots were interviewed to gain an in-depth insight into how locals perceive their edible and decorative gardens [114].

3.2. Case Study: Cypriot Houses

The island of Cyprus is situated in the Eastern Mediterranean region and is one of the islands of the Aegean Sea (Crete, Dodecanese, Cyclades) and the coastal Levant. The Cyprus climate can be considered a subtropical climate that is a mixture of semi-arid and Mediterranean climates. The general characteristics of the Cyprus climate can be described as severe solar radiation and clear skies, with long hot and humid summer months brought about by constant atmospheric subsidence influenced by the Hadley circulation and the Asian monsoon, as well as mild and rainy winters influenced by westward-moving cyclones [118]. Cyprus can be divided into three following climatic regions: coastal, lowland, semi-mountainous, and mountainous [119]. The coastal region of Kyrenia (Kyrenia and Lapta) is under the influence of coastal climatic conditions. Due to its geography (closeness to the sea), the coastal region suffers from high humidity levels. The coastal region has mild winters and long hot and humid summers. As mentioned before, the typology of selected residential buildings in the Kyrenia district includes: (1) detached villas and semi-detached villas, (2) row houses, and (3) apartment buildings. For each selected case study, the following spaces are studied: doorways, window sills, balconies, external walls, rooftops, gardens, and garden walls.

In the case of detached villas and semi-detached villas, containers and pots of various sizes are arranged in the doorways. If a ceiling protects the doorway, suspended baskets are usually hung from the ceiling. Small pots are generally arranged in window sills. In the case of villas with balconies, railing planters are installed on balustrades. Containers of various sizes and pots are arranged on the balcony floors. Suspended baskets are hung from the balcony ceilings. In some balconies that are not covered, trellises are added to the balconies to support grapevines. In detached villas and semi-detached villas, external walls and roofs are seldom used for arranging green decorative elements. Fruit trees (walnut, fig, lemon, orange, almond, strawberry, and grapevine), vegetables (lettuce, tomatoes, and peppers), and herbs (basil, coriander, rosemary, mint, and parsley) are usually planted within the visited gardens. The harvest is either consumed by the household or shared with family members and friends. Containers and pots of various sizes are usually arranged in the gardens. In some gardens, trellises are made to support the grapevines. In some gardens, wooden shelves are made, and pots and containers of various sizes are arranged. Railing planters are typically installed if the garden wall is made out of a fence (Figures 5–8).

The visited row houses have front yards with edible gardens. Fruit trees, vegetables, and herbs are usually planted in the gardens. In some visited gardens, trellises are installed to support the grapevines. In some visited gardens, pots of various sizes are suspended

from the trellises. Containers and pots of various sizes are arranged in the front yards, doorways, and windowsills. Railing planters are usually installed on the garden fences. If the garden walls are made of solid materials, containers and pots are put on them. In some row houses, semi-open spaces are attached to the buildings. In these cases, suspended baskets are hung from the semi-open spaces. In some visited row houses, tables are put on the garden, and pots of various sizes are arranged (Figures 9–12).



Figure 5. Detached villa with greeneries (photos by authors).



Figure 6. Balconies with green elements (photos by authors).

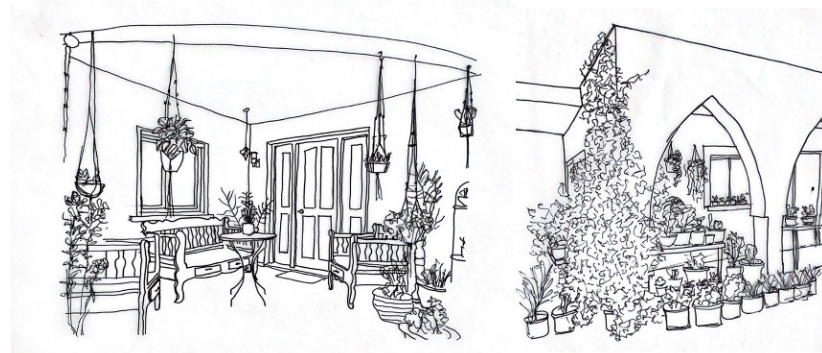


Figure 7. Two sketches illustrating green elements in doorways.

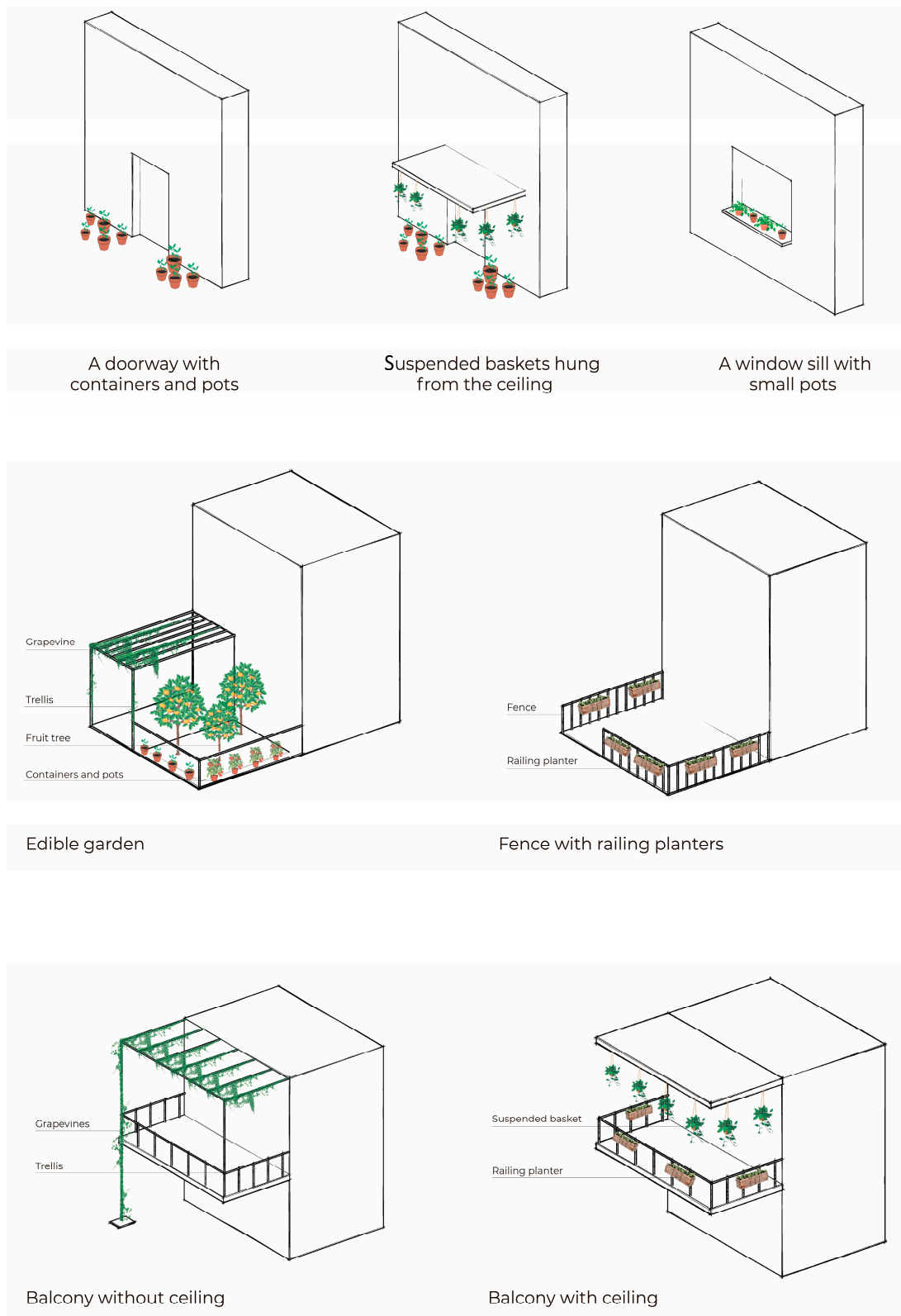


Figure 8. The arrangement of various green elements in the visited detached villas.



Figure 9. Row houses with greeneries (photos by authors).



Figure 10. Row houses with greeneries (photos by authors).

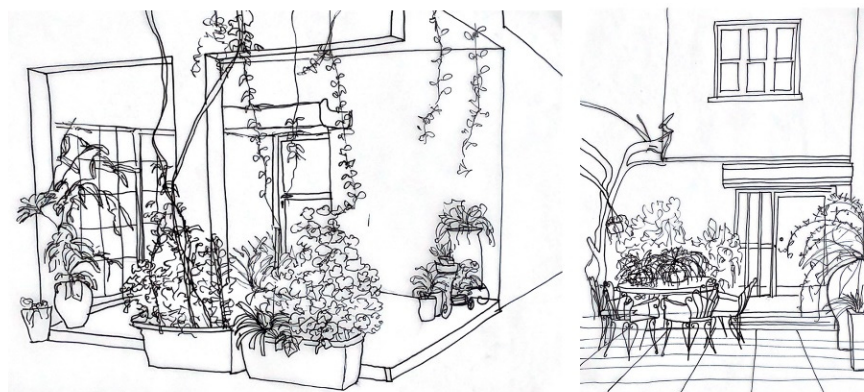


Figure 11. Two sketches illustrating green elements in the visited row houses.

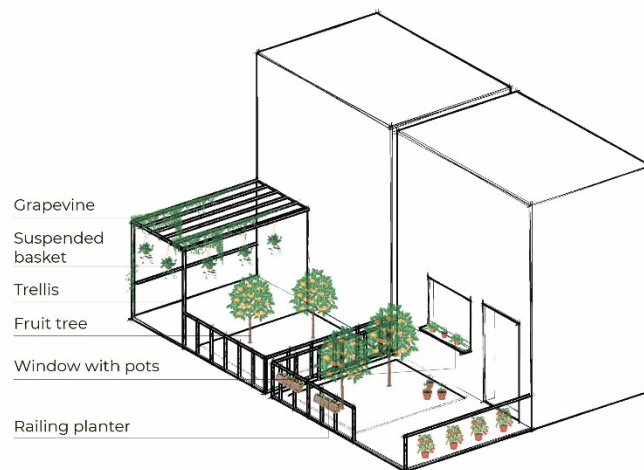


Figure 12. A diagram illustrating various green elements arrangements in the visited row houses.

Considering the apartment buildings, the available spaces dedicated to green elements are limited compared to the detached villas, semi-detached villas, and row houses. Decorative green elements are commonly used in the ground level of the visited apartment buildings. Containers and pots of various sizes are placed in the entrance areas, doorways, and gardens. In some cases, window sills are used for small pots. In some apartment buildings, French windows are installed. In such cases, small pots and containers are placed on sills. Balconies are usually decorated with greenery. Balcony railing planters are installed on balustrades. In some cases, baskets and pots are suspended from the balustrades. Containers and pots are put on the balcony floors. Suspended baskets are hung from the balcony ceilings. Shelves are attached to the balcony walls, and pots of various sizes are put on the shelves. The external walls and rooftops of the apartment buildings are seldom used for arranging green decorative elements. The practice of arranging and maintaining green decorative elements in apartment buildings with limited spaces demonstrates that Cypriots living in apartment buildings are eager to keep and maintain their relationship with greenery (Figures 13–16).



Figure 13. Green element arrangements in two balconies (photos by authors).



Figure 14. Two balconies with green elements (photos by authors).



Figure 15. Two sketches illustrating green elements arrangements in the visited apartment buildings.

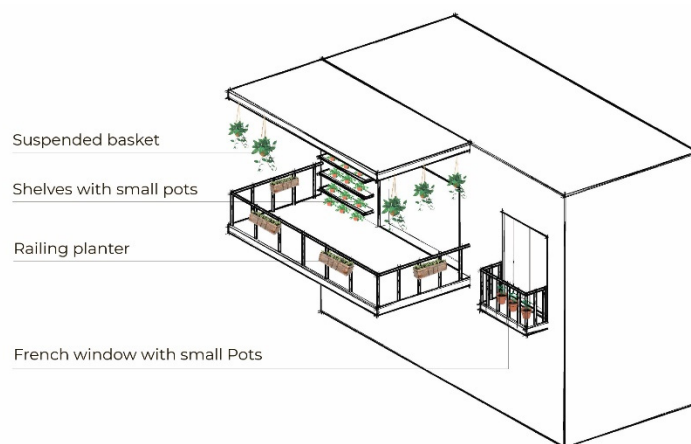


Figure 16. A diagram illustrating the various arrangements of the green elements in the visited apartment buildings.

4. Results: Interior Design Studio Pedagogy

The design studio can be considered the core of interior architecture education [7]. The interior design studio facilitates a physical space for young interior architects to work and cohabit. It facilitates teaching and learning interactions between young interior architects and studio lecturers [3]. It provides the foundation of pedagogy that focuses on incorporating the concepts of residential urban agriculture, the context-based and culture-based design approach, and social sustainability within the design studios. The design studio can provide a solid ground where ideas or problems can be pointed to and proposed design solutions. Moreover, young interior architects can acquire essential knowledge and skills concerning the subjects they are focusing on in the design studios [7]. The interior design pedagogy regards design as a process [120]. Young interior architects in the interior

design studio (INT 401) experience the design process through the following three principal phases: context analysis, research, and design.

The first phase is the context analysis phase. For phase one, step one, the studio lecturers usually select a residential building within the Kyrenia district. As part of the studio objectives, young interior architects must deliver design resolutions for the interior spaces, balconies, and rooftops of the selected building. Young interior architects are asked to visit the designated residential building and visually analyze the building and its site. For phase one, step two, young interior architects must conduct fieldwork and visit Cypriot residential buildings and provide a visual analysis of how green decorative elements and edible landscapes are arranged and maintained in them. Young interior architects are encouraged to converse with the locals to gain in-depth insights regarding mentioned local practices. New insights regarding meanings local people ascribe to their everyday practices can be gained [121]. Young interior architects must share their collected data with the studio lecturers and their peers.

The second phase is the research phase. For phase two, step one, the interior design lecturers provide the following fundamental topics which are essential for the design development: (1) producing food in interior and exterior spaces by utilizing soil-based systems and non-soil-based systems; (2) cultivating food on vertical surfaces by utilizing vertical gardens; (3) attaching greenhouses to the building (elevations and rooftop) and cultivating food in them using hydroponic systems; and (4) creating a rooftop garden by designing a rooftop container garden or hydroponic system on the roof and adding a greenhouse to the roof with a hydroponic system in it. In addition to these topics, the studio lecturers also discuss the core principle themes of social sustainability. These topics are delivered to young interior architects via weekly lectures. Young interior architects are encouraged to research these topics and share their findings with other young designers and studio lecturers. The research process is considered a key aspect of studio pedagogy. By engaging in regular weekly research, young interior architects can gain new insights regarding innovative practices and products and interpret them within their design proposals [122].

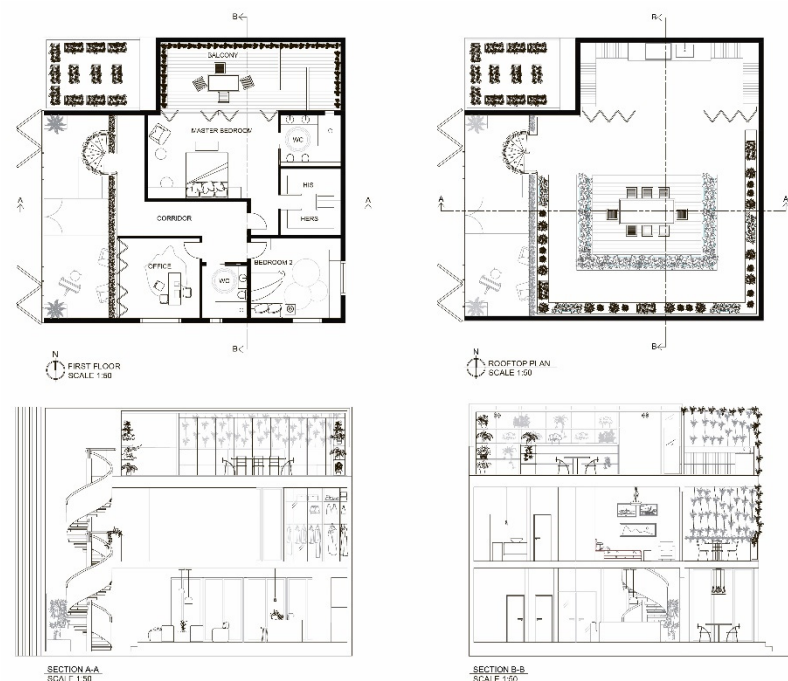
For phase two, step two, young interior architects must engage in rigorous search and identify successful case study interior design projects. Each selected case study project consists of various design propositions. Young interior architect must identify the successful design propositions for each selected case study project. Each interior architect is expected to build an inventory of design propositions that can be utilized during the design process.

Phase three is the design phase. The design studio views design as a specific activity that links theory and practice; it bridges scientific activity with creative one to respond to a series of problems [123]. For phase three, step one, the identified design propositions are restudied and interpreted within the initial design proposals by considering the project context. It is expected that selected design propositions are contextualized within the design proposals. For step two, young interior architects must consider the data they gathered during their fieldwork regarding local practices of arranging and maintaining green decorative elements and edible gardens and reflect them within their design proposals. They must integrate innovative approaches for cultivating food in interior and exterior spaces within their initial design proposals. Young interior architects must share their proposals with the studio lecturers and peers and receive regular feedback. Young interior architects refine their proposals by receiving feedback via a process. In this way, new proposals contain refined design propositions [121]. The outcome of the design phase is the final design project. Table 2 demonstrates the three phases of the design process in the interior design studio.

Table 2. The three phases of the design process.

Phase one: context analysis	<ol style="list-style-type: none"> 1. Visit the designated residential building and provide visual analysis. 2. Conduct fieldworks and visit Cypriot houses. Provide visual analysis of the ways green elements and edible gardens are arranged. 3. Converse with the locals and learn about local practices.
Phase two: research phase	<ol style="list-style-type: none"> 1. Deliver necessary theoretical background to young designers via weekly lectures. 2. Engage in research with young designers. 3. Select and identify successful case study interior design projects. Identify successful design propositions for each case study. Build an inventory of design propositions.
Phase three: design process	<ol style="list-style-type: none"> 1. Interpret the selected design propositions within the initial design proposal. 2. Integrate the innovative approaches for cultivating food within the initial design proposal. 3. Deliver the initial design proposal and receive feedback. 4. Deliver the final design project.

A summary describing one sample design project developed in the interior design studio (INT 401) is described here. Young interior architects must design the interior spaces, envelopes, and the rooftop of an existing residential building in Bellapais, Kyrenia. The project aims to integrate the concept of residential urban agriculture within the interior design of the building. Pumpkin, spinach, parsley, grapes, cherry tomatoes, lettuce, peppermint, and beans are proposed to be cultivated in the mentioned spaces. The ground floor consists of an entry area, living room, kitchen, and guest room. The first floor includes two bedrooms, a home office, and a balcony (Figure 17).

**Figure 17.** Plans and sections of the project [124].

Young interior architects added hydroponic systems with grow lights to the interior walls on the ground floor. Spinach, thyme, and beans are proposed to be cultivated using hydroponic systems. A green house is attached to the ground floor, and pots with supporting structures are installed to cultivate cherry tomatoes. Containers and pots are arranged on the balcony on the first floor. Supporting structures are installed in the balcony, and baskets are attached. A supporting structure extends from the balcony to the rooftop in order to provide support for a grapevine. Railing planters are installed on the balustrade on the first floor. A green house is installed on the rooftop, and various shelves are arranged. Containers and pots are arranged on the shelves. A trellis is added to the rooftop to support the grapevine (Figures 18 and 19).



Figure 18. Four perspectives illustrating the incorporation of the green elements within the design project [124].

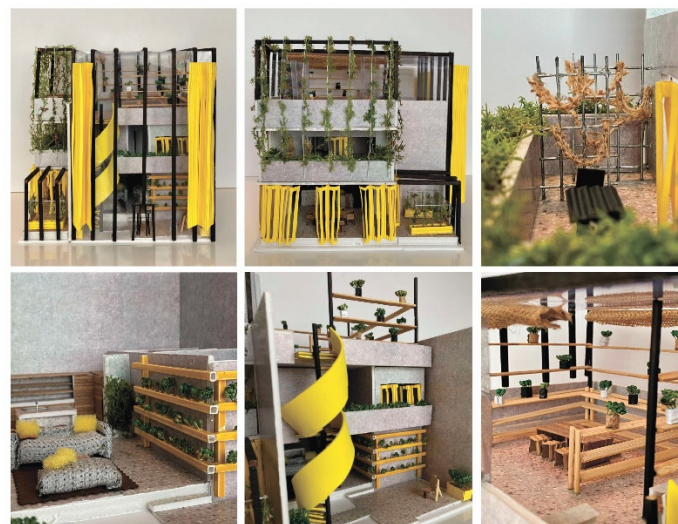


Figure 19. The physical model showing the proposed green elements within the design project [124].

The INT 401 interior design studio-V learning outcomes are in conjunction with social sustainability and residential urban agriculture. The INT 401 learning outcomes can be summarized as follows. Outcome one: young interior architects learn that their design proposals have impacts within a particular society and can enhance the locals' well-being and quality of life. By implementing the concept of residential urban agriculture within the interior design studio, young interior architects become aware of the following notion: residential urban agriculture can generate jobs and contribute to economic security and food security of low-income people, enhancing the quality of life and well-being of people [26,35,39,40]. This notion is in line with the development sustainability, which argues

that by satisfying people's basic needs in a society, their quality of life and well-being can be improved [1]. Outcome two: young interior architects learn to consider local practices and traditions and improve them by utilizing existing innovative approaches. Through various fieldwork, young interior architects study how Cypriots arrange and maintain their green decorative elements and edible gardens. During the design process, they are encouraged to integrate innovative methods of cultivating food in their design proposals, such as cultivating food in indoor spaces, vertical surfaces, and rooftops to sustain and enhance the existing local practices. This notion aligns with the non-transformative approach in bridge sustainability [1]. Outcome three: young interior architects learn to study local traditions, value them, and reflect them in their design projects. Such reflections align with the maintenance of social sustainability, which focuses on promoting and valuing existing traditional practices in a particular society [1]. The studio lecturers believe that by integrating social sustainability in the interior design studio, the awareness of young interior architects concerning social sustainability and its vital role in the discipline of interior design can be elevated [7]. Table 3 presents the proposed pedagogical framework, which is developed for the interior design studio (INT 401), and it consists of the three following sections: (1) residential urban agriculture, (2) the context-based and culture-based design approach, and (3) social sustainability.

Table 3. The proposed pedagogical framework for the interior design studio.

Residential urban agriculture
<ul style="list-style-type: none"> • Producing food in interior spaces using hydroponic systems. • Cultivating food in underutilized interior spaces by utilizing hydroponic systems and grow lights. • Utilizing Living wall systems in interior and exterior spaces. • Cultivating food in vertical surfaces such as the building's envelope by utilizing vertical gardens. • Attaching green houses to the building (elevations and roof) and cultivating food with hydroponic systems inside the green houses. • Creating roof top garden by creating roof top container garden on the roof and adding a greenhouse to the roof with hydroponic systems in it.
The context-based and culture-based design approach
<ul style="list-style-type: none"> • Engaging in ethnographic methods of data collection and conduct various field works. • Arranging various decorative green elements in visited Cypriot houses in the following spaces: doorways, balconies, semi-open spaces, windowsills, gardens, and garden walls. • Maintaining edible gardens which are popular among the Cypriots. • In Cypriot culture, there is a strong bond between the Cypriots and their gardens.
Social sustainability
<ul style="list-style-type: none"> • Development sustainability: satisfying the basic needs of people in a society to improve their quality of life and well-being. • Bridge sustainability: enhancing the existing traditional practices by proposing innovative technologies and approaches. • Maintenance sustainability: promoting and valuing existing traditional practices in a particular society.

The three phases of the design process (Table 2) and the proposed interior design pedagogy framework (Table 3) have already been applied in the interior design studio-V (INT 401). The proposed design process and pedagogy framework can be applied to other interior design studios in the island since the climate, and local practices are similar. The proposed design process and the pedagogy framework can be implemented in other interior design studios within the Mediterranean region due to the similar climatic conditions and local practices.

The proposed design process and the pedagogy framework are distinctive from existing interior design pedagogies because (1) it values existing local practices and attempts to implement them within the design process (conventional interior design studios usually overlook local practices, traditions, and values; therefore, the studio outcome is not responsive to the local context); (2) it tries to integrate the concept of residential urban agriculture within the design process; (3) it regards interior spaces and its adjacent spaces as grounds where food can be cultivated; and (4) the proposed design process and the pedagogy framework consider social sustainability in its core.

The proposed pedagogy implemented in INT 401 is a response to Smith, Beeck, Lommerse, and Metcalfe's [71] call for considering social sustainability within the discipline of interior architecture. These authors argue that interior designers should engage with the specific community to deliver design projects. The community's social capital or assets, processes, and environments should be considered during the design process. The final design outcome based on community engagement can elevate local people's quality of life and well-being. Community engagement provides the foundation for interior designers to study and learn local practices and reflect them in their design proposals. In fact, learning for social sustainability should be grounded in existing experiences [3].

The studio lecturers believe that the discipline of interior architecture does not operate in a vacuum. The discipline of interior architecture designs environments where individuals reside and work in diverse communities. In fact, the discipline is involved in working for the community. Therefore, it can serve the local community and the local context to value their local practices, traditions, and culture [125–127]. In this way, the design studio outcome can enhance individuals' quality of life and well-being in a specific locality.

4.1. Limitations of the Proposed Framework

It is evident that the notion of cultivating food within interior and exterior spaces (residential urban agriculture) pose obstacles. The following issues are associated with the idea that cultivating food in interior and exterior spaces in dense urban centers should be considered by young interior architects through the design process. There are various issues linked with practicing urban agriculture in various urban centers in developing and developed countries. (1) In the majority of developing countries, the practice of urban agriculture is considered as a rural activity and, as a result, it is considered illegal. (2) In terms of contributing to urban economy, urban agriculture is regarded as a type of profession with minor contribution. (3) There are potential health hazards associated with practicing urban agriculture. Cultivating food in polluted dense urban centers may pose a major threat to public health. Regarding this issue, regulations and prevention measures are necessary. There are potential health issues when wastewater is utilized for irrigation. The use of chemical fertilizers can contribute to potential environmental issues. Inappropriately utilized pesticides may cause contamination. Leafy vegetables can become contaminated by absorbing lead in soil and air. The soil in land near industrial discharges or roads can be contaminated with heavy metals. (4) In dense urban centers, there is a lack of available land suitable for urban agriculture. The available land which is suitable for urban agriculture can be utilized for developing urban housing and other building typologies. (5) Due to the lack of available land, individuals who are interested in cultivation are not able to practice [37,86,128].

Hydroponic systems require energy to operate. It utilizes electricity for pumps and grow lights. In interior spaces, due to the lack of natural light, grow lights should be installed which requires electricity. In regions with regular power outages, operating the hydroponic systems can be an issue. Cultivating food using hydroponic systems requires initial investment. Farmers are required to know how the system functions. Nutrient solutions and water levels requires regular maintenance [129]. Currently, the existing hydroponic systems mainly utilize fertilizers in order to optimize yields. Due to the fact that hydroponic systems utilize fertilizers, there is little acceptance in society and people are critical of their use. Usually, consumers prefer naturally produced food [35,130].

The following points should be considered regarding installing greenhouse on the rooftop. (1) The building's structure should be able to support the extra load. (2) Constructing and installing greenhouses requires initial investment. For low-income people, the initial investment can be too high. (3) Adding green house to rooftop requires regular access to the rooftop by the farmers [35].

4.2. Novelty of the Proposed Framework

The integration of the sustainability concept into the interior architecture discipline is a crucial task. Within the discipline of interior architecture, the existing sustainability research mainly focuses on ecological aspects. Although ecological aspects are vital and should be considered during the design process, the social aspect should not be overlooked [7]. The novelty of the proposed framework is centered around a futuristic vision. It incorporates the concept of urban agriculture within the interior design studio pedagogy. The proposed framework regards interior and exterior spaces as grounds where food can be cultivated. The proposed framework values local practices and attempts to mirror it within the interior design studio.

5. Discussion

As mentioned before, the principal goal of the interior design studio-V (INT 401) is to incorporate the concept of residential urban agriculture within the studio pedagogy. Currently, in various schools of architecture, the incorporation of food production with architecture has been explored. The Department of Architecture at Ryerson University focuses on the issue of food production in urban centers. Architecture students in their first, second, third, and fourth years experienced architectural designs which involved food production [131].

The interior design studio-V (INT 401) and the architecture design studios at the Department of Architecture at Ryerson University share the following pedagogical experiences: (1) both design studios view the concept of food production and urban agriculture as interior architecture and architecture issues; (2) by focusing on the issue of food production, the local community can benefit; (3) concerning food production, young designers gain technical knowledge, such as greenhouse design, rooftop garden design, hydroponic systems, indoor farming, and similar topics; (4) the issue of food production in urban centers as a point of departure proved to be excellent for highlighting various of issues, such as local cultural context, social sustainability, social justice, and social inclusion; and (5) young designers have a chance to consider the food security issue and propose innovative ways to address it within their design projects [131].

Various interior and architecture design studios focus on incorporating the sustainability concept within the studio pedagogy [2–4,132–134]. Topics such as the adaptive reuse of old buildings, sustainable design principles, sustainable materials, sustainable construction methods, water conservation strategies, indoor air quality, and the recycling of waste materials are discussed within these design studios. The principal goal is to propose design projects which are energy-efficient and have a minimum negative impact on the environment [132,133].

Similar to other interior design studios, the interior design studio-V (INT 401) focuses on the sustainability concept. What makes the interior design studio-V (INT 401) different from other interior design studios is its emphasis on the social aspect of sustainability. The interior design studio-V (INT 401) believes that the discipline of interior architecture has a social obligation. The discipline can respond to social needs, and the proposed design projects within the design studio are capable of impacting the society [135,136]. The interior design studio-V (INT 401) believes that the proposed design projects should respond to the social condition of the context within which it exists. In this way, the interior design studio is capable of educating individuals who are environmentally conscious and are mindful of local social and cultural contexts [132,137].

6. Conclusions

The main aim is to propose a pedagogical framework for the interior design studio-V (INT 401). The design studio attempts to consider contemporary and future issues, such as population growth, urbanization, a decline in arable land, and the demand for additional crop production, and proposes a pedagogical framework responsive to the mentioned issues. The proposed studio framework incorporates the following three concepts in its core: (1) residential urban agriculture, (2) the context-based and culture-based design approach, and (3) social sustainability. A summary of each concept is discussed below.

- (1) The concept of residential urban agriculture is based on the notion that future interior and exterior spaces (such as window sills, beneath skylights; south-, east-, and west-facing rooms; balconies; south-, east-, and west-facing elevations; and rooftops) are ideal grounds for cultivating food. Innovative methods for cultivating food, such as hydroponic systems equipped with grow lights, can be utilized in interior spaces, balconies, and rooftops. Greenhouses can be added to the building's elevations, windows, and rooftops, and food can be cultivated in them. The studio lecturers believe that by practicing residential urban agriculture and cultivating food in future cities, the future burden on the agriculture sector can be reduced. Furthermore, by practicing urban agriculture, social, economic, and environmental benefits can be gained.
- (2) By following the context-based and culture-based design approach, young interior architects record how Cypriots arrange and maintain their edible gardens and green decorative elements within their residential buildings in the Kyrenia district. This design approach encourages young interior architects to value, study, and reflect mentioned local practices within their interior design projects.
- (3) The proposed studio pedagogy also considers the social aspect of sustainability. The incorporation of social aspects of sustainability within the studio pedagogy can be considered a response to contemporary as well as future social and environmental issues. The studio pedagogy is intertwined with the threefold social sustainability that comprises development, bridge, and maintenance sustainability. The principal goals of the mentioned threefold schema are as follows. (1) Development sustainability focuses on satisfying the basic needs of individuals in a society. Practicing residential urban agriculture can enhance access to a nutritious diet and, in this way, one of the basic needs of individuals in a society can be satisfied. The proposed studio pedagogy attempts to be responsive to real social, environmental, and economic issues, such as satisfying people's basic needs in a society. (2) Bridge sustainability, the proposed studio pedagogy, focuses on a non-transformative approach, which means that young interior architects are encouraged to integrate innovative food production methods within their design projects. The studio lecturers believe that local Cypriots can utilize innovative food production methods in their residential buildings considering their local practices. (3) Maintenance sustainability focuses on maintaining traditions and practices that local people in a society are eager to preserve. Fieldwork results show that local Cypriots are generally interested in cultivating food and decorating their residential buildings with green elements. The proposed studio pedagogy recognizes and values local practices and encourages young interior architects to integrate them into their design projects.

6.1. Academic/Practical Implications

In response to research question one ("how can the concept of residential urban agriculture influence the interior design studio pedagogy?"), it is worth mentioning that the interior design studio is based on future interior spaces and their adjacent spaces, such as balconies, windowsills, building envelopes, and rooftops, and the vision that they are potential spaces capable of cultivating food. This futuristic vision has influenced the interior design pedagogy in the following ways. (1) Young interior architects' perception of interior and exterior spaces has changed. Young interior architects start to consider interior and

exterior spaces as ideal grounds for cultivating food. (2) Young interior architects' technical knowledge regarding various food-cultivating methods, such as soil-based systems and non-soil-based systems, vertical gardens, indoor farming, and integrating greenhouses with buildings, has improved; (3) young interior architects learn to be sensitive to the existing local practices, traditions, and values and reflect them in their design projects; and (4) young interior architects learn that their final design projects can be responsive to the real contemporary and future issues.

Research question two ("in which ways the concepts of social sustainability and residential urban agriculture are embedded with the design studio learning outcomes?") was addressed in Section 4.

The first part of research question three ("what are the ways Cypriots arrange and maintain their edible gardens and green decorative elements within their residential buildings in Kyrenia district?") was explored in Section 3.2. Concerning the second part ("how such local practices can be integrated within the interior design studio?"), the following points should be highlighted: (1) a shift in studio pedagogy is necessary; (2) the studio lecturers should be open to the mentioned concepts and willing to change their existing established pedagogies; (3) the studio lecturers and young interior architects need to engage in various fieldworks, study the local context, and collect data; and (4) the studio lecturers and young interior architects need to be open to value existing local practices, as well as study them and reflect them within their design proposals.

The following recommendations for other interior design lecturers can be made. (1) Consider the local context: interior design studios can establish a dialogue with the local context. In this way, local values and practices can be appreciated, studied, and reflected within the interior design studio. (2) Be responsive to the contemporary and future issues: the interior design studio can be responsive to the real contemporary and future social, environmental, and economic issues. (3) Create a vision for the interior design studio: the design studio can be based on a vision. Defining a vision for the interior design studio is a crucial task. The design studio vision is the bedrock of the studio, and it can influence the studio pedagogy.

6.2. Future Research

The studio lecturers believe that the proposed pedagogical framework can be applied to other interior design studios on the island since the climate and local practices are similar. The proposed pedagogy framework can be implemented in other interior design studios within the Mediterranean context due to the similar climatic conditions and local practices. Future research can apply the proposed pedagogy framework to other interior design studios, and the outcome can be examined and shared.

The pedagogical framework which has been proposed in this research can be replicated in other interior design studios based on the following conditions: (1) the climate of the region should be suitable for practicing residential urban agriculture; (2) indoor residential urban agriculture can be proposed in regions with hostile climates; (3) the local context should be receptive towards applying residential urban agriculture; (4) the proposed pedagogy can be applied within the interior design studios with particular emphasis on ecological and social sustainability; (5) the proposed pedagogy requires a research-based design process; and (6) the proposed framework can be applied in interior design studios whereby young interior architects are equipped with the basic knowledge of designing residential interiors.

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