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Research on a Framework for Sustainable Campus Eco-Architecture Selection: Taking a Taiwan High School as an Example

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Abstract: With the advancement of human science and technology, the continuous increase in the construction and functional improvement of campus buildings and school teaching infrastructure cannot avoid adverse impacts on the overall environment. Therefore, sustainability assessments of buildings are indispensable for the sustainable development of the surrounding region. The main goal of the sustainable design of campus buildings is to reduce the depletion of key resources, such as water and energy, as well as to lower carbon emissions; this, in turn, creates a safe and effective campus environment. Comprehensive assessments of campus buildings have become critical to achieving national and regional sustainability. Therefore, this study compiles a set of building construction indicators suitable for a framework for high school campus architecture and ecological development in Taiwan, conforms these indicators to climatic characteristics, and considers an evaluation model for sustainable building concepts. This research uses the Fuzzy Delphi Method (FDM) and the Fuzzy Analysis Hierarchical Procedure Method (FAHP) to gather data using expert questionnaires. We examine three relevant factors: (1) the main factor, campus space architecture, is the most important measure of sustainable buildings; (2) the second factor is the campus ecological environment; (3) the third measure of the sustainable campus buildings is a healthy environment. The top 20 elements of the sustainable campus building evaluation index were obtained through FAHP analysis, with an overall cumulative weight value of 81.06%. This research may provide a resource allocation reference for government bodies or the construction industry, assisting them in building sustainable buildings in the future.

Keywords: eco-construction; fuzzy analysis hierarchical procedure; fuzzy Delphi method; high school; sustainable campus

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Citation: Liao, C.-W.; Lin, J.-H.; Chen, T.-W. Research on a Framework for Sustainable Campus Eco-Architecture Selection: Taking a Taiwan High School as an Example. *Sustainability* **2022**, *14*, 6265. https://doi.org/10.3390/su14106265

Academic Editors: Danièle Waldmann-Diederich, Laddu Bhagya Jayasinghe and Avi Friedman

Received: 24 March 2022
Accepted: 13 May 2022
Published: 20 May 2022

1. Introduction

Global population growth in recent years has resulted in extensive discussions on the availability and utilization of natural resources such as water, land, and forests, coupled with the depletion of minerals [1]. Many issues related to the sustainability of human life continue to be explored. These include the use of reserves and non-renewable resources such as fossil fuels, urbanization, pollution, geopolitical issues, habitat destruction/deterioration, global warming, stratospheric ozone depletion, soil erosion, acid deposition, waste disposal, and indoor environmental quality [2,3]. Sustainable architectural building performance standards and indicators can be used to assess the performance of a building or facility and measure its impact on the environment, and these assessments enable stakeholders to address specific environmental issues comprehensively [4]. The need for sustainable building design continues to increase [5,6]. It has become increasingly important to develop mechanisms or models that can assist designers in assessing a proposed building's sustainability, cost-effectiveness, and ability to meet human needs. Furthermore, with the advancement of science and technology, construction of various types, including infrastructure and campus buildings, continues to increase; this will inevitably hurt the environment [7]. Moreover, these negative impacts are evident throughout the life cycle of a building. Sustainable building practice aims to reduce impacts on the environment by promoting environmentally responsible building practices, improving the efficiency of energy and resource use, and designing building plans to reduce carbon footprints and establish a sustainable environment [6,8].

The use and development of sustainable building assessment tools are now being adopted in developing countries. The concept of "green" is also emerging in various regions of the world, and it is urgent to standardize "sustainability" to cover a wide range of sustainable development [8,9]. Experts and scholars from various countries are also actively developing building assessment tools to meet the needs of all areas of sustainable development, such as the environment, society, the economy, safety, and education [10]. Sustainability assessments of ecologically-sound campus buildings have become indispensable for the sustainable development of schools. The main goal of sustainable design is to reduce the depletion of key resources such as energy, water, and raw materials; these efficiencies have environmental impacts throughout the building's operational life cycle and, in turn, create a safe and ecologically-sound built environment that facilitates 'environmental education [8,10]. The comprehensive evaluation method is linked to the idea of a system of sustainable buildings on an ecologically-sound campus and can be applied to the pre-design, construction, operation, and maintenance of sustainable buildings, as well as related considerations, until the end of the main building's life [11]. The places where a person receives formal education in the process of growing up are mostly schools at all levels, such as elementary schools, junior high schools, high schools, and universities [11,12]. The campus environment covers a wide range of physical areas on the campus, including school buildings and related factors, such as structures, infrastructure, the site where the school is located, its surrounding environment (including air, water, and other substances that students may come into contact with), the use of adjacent land, roads, etc.

Worldwide, school principals and the directors of campuses have spared no effort to promote the sustainability of their campus environments. They may focus on the concept of a green school, eco-school, seed school, green university, etc. [13], or they may prioritize interdisciplinary plans and action plans, but they all share the common goal of the sustainable development of the campus environment [14]. Sustainable campuses focus on "environmental sustainability", the "ecological cycle", and being "healthy". In addition to the substantive connotations of "energy conservation" and "resource recycling", sustainable campuses integrate the common awareness of the community by breaking down barriers. In contrast to traditional campuses' closed environment and standard management principles, sustainable practices transform the campus environment into a public activity space and an environmental education base with community characteristics [14,15]. It is imperative to pursue the construction and maintenance of ecological campus environments and apply sustainable building technologies. Although a significant body of research results has been accumulated concerning on-campus environmental assessments and sustainable development indicators [8,15], most of the existing research focuses on one or only a few aspects, such as resources, energy, ecology, and environmental education, and does not comprehensively consider the correlation between campus environmental assessments and sustainable development indicators. Especially in Taiwan, which is located in a subtropical climate zone, there is an urgent need for substantive environmental assessments of sustainable high school campuses; however, a multi-faceted and objective assessment tool has not yet been developed. In addition, in 2015, the United Nations announced its 2030 Sustainable Development Goals, including 17 goals such as poverty eradication, climate change mitigation, and gender equality promotion, guiding the world to work together towards sustainability. To allow the concept of sustainability to sprout on campus, we start with the school's built environment, allowing students to understand the concept of sustainability through an immersive environment; this is the innovation and importance of this research.

2. Literature Review

2.1. Sustainable Buildings

In past reports from the International Energy Agency (IEA), buildings consume approximately 30% to 40% of the world's energy. The global energy and electricity consumption in the Global Energy Review 2020 has been greatly reduced, but the construction industry is still not a small load on the global environment [16]. In the sustainable construction topic, global construction researchers have proposed various solutions, including the use of minimal impact materials, the use of natural materials, and recycling as much as possible [17]. Due to the current global population growth trend, the construction industry consumes a lot of resources and energy, and this situation is expected to worsen in the near future [16]. According to research indicating that the operation of buildings consumes about 40% of the total global energy, the purpose of building environmental assessment can be used for sustainable building design, construction, operation, maintenance, and renovation [18]. Collaboration between civil engineers, architects, designers, environmentalists, and other experts from different fields of building performance is required. Sustainable architecture involves the entire life cycle of a building, thus taking into account environmental qualities, functional qualities, social and cultural factors, economic factors, and future value.

Sustainability is emerging as a key consideration for builders to increase economic efficiency, protect and restore ecosystems, and improve human well-being [19]. Therefore, to achieve sustainability, the following objectives should be met: "Minimize the loss of materials and energy"; "Material Reusability and Recyclability"; "Human satisfaction"; "Minimal environmental impact and embodying alternative energy sources". Sustainable architecture is a multi-dimensional concept. The focus on this issue often only focuses on environmental indicators while ignoring the importance of social, economic, and cultural indicators. Building sustainability involves a complex structure of interrelationships between built, natural, and social systems, requiring different priorities at each stage of a building's life cycle [20–22]. While considering sustainable building indicators, it is also necessary to evaluate the harmonious coexistence with the surrounding environment, whether in terms of biological, location, or climatic viewpoints. Living and working create multiple values of comfort, attractiveness, and health [20,23].

Sustainable buildings can be continuously improved beyond environmental indicators, such as the amount of energy required for the construction and operation of the building [24]. The level of harmful gas emissions, water consumption, etc., must also include social and economic aspects of design assessment quality, including other internal building living comfort, functionality, total building life cycle cost, community integration, public engagement, and location [25]. However, the ongoing control of all aspects of sustainability in building construction, and while still at an early design stage, it is very challenging to assess its sustainability impact on the final result [24]. Therefore, there is a need for a data tool to assess the importance of various criteria for achieving sustainability solutions [26].

2.2. Eco-Architecture

Ecological architecture is based on the local natural ecological environment, using the basic principles of ecology, building technology science, and modern scientific and technological means in order to rationally arrange and organize the relationship between buildings and other related factors [27]. Make the building and the environment an organic combination, with good indoor climate conditions and strong bioclimatic adjustment ability to meet the comfort of people's living and living environment, so that people, buildings, and the natural ecological environment form an organic combination, a virtuous circulatory system [28]. In today's world, natural resources are drastically reduced, the climate is changing, the ecological environment is being destroyed, and the global environmental problems are becoming more and more serious. To improve various impacts on the earth's environment, sustainability must be paid attention to [29,30]. In the face of the grim reality, people have to re-examine and evaluate the urban development concept and value system that we are now taking as our creed. Architecture and its built environment play an important role in the impact of human beings on natural environments. Therefore, a design that conforms to the principles of sustainable development requires a comprehensive consideration of the efficiency of resource and energy use, the impact on health, and the choice of materials, so that it meets the requirements of the principles of sustainable development [31]. The construction theory of ecological buildings and ecological cities put forward in recent years is based on the principles of natural ecology, exploring the relationship between people, buildings, and nature and creating the most comfortable, reasonable, and sustainable environment for human beings. Ecological architecture is the development direction of architectural design in the 21st century. Eco-architecture is also known as green building or sustainable building. Eco-architecture involves a wide range of aspects, is the intersection of multiple disciplines and types of work and is a comprehensive systematic project that requires the attention and participation of the entire society. It takes the balanced interaction between human society and the natural world as the starting point of development and takes man as a member of nature to re-understand and define the position of himself and his manufactured environment in the world [32]. Eco-architecture cannot be achieved by just a few architects, nor can it be accomplished overnight [29]. It represents the direction of the new century and is the goal that architects should strive to achieve. Ecology refers to the relationship between people and nature, so ecological architecture should handle the relationship between people, architecture, and nature [33]. Humidity, clean air, good light environment, sound environment and flexible and open space with long-term effects and multiple adaptabilities, etc.); at the same time, it is necessary to protect the surrounding environment-the natural environment (that is, the demands on nature should have less and less negative impacts on the natural environment). From the above aspects alone, it can be seen that no matter which aspect requires the cooperation of multiple types of work, it requires the cooperation of structures, equipment, gardening, and other types of work, and the cooperation of disciplines such as building physics and building materials can be realized. Among them, the architect plays a leading role, and the architect must conceive the concept as a whole with the concept of campus ecology and integration. At the level of specific implementation and operation, campuses' ecological architectural design should focus on grasping and using the characteristics and laws of natural ecology that were ignored in previous architectural designs, implementing the principle of overall priority, and trying to create a harmonious coexistence between the artificial environment and the natural environment, oriented towards the sustainable development of the campus building environment of the future [31,33,34].

2.3. Ecological Technology and Economic Conditions

The original ecological architectural design was to achieve the purpose of colocalization without or rarely using modern technical means under the conditions of an economic economy and low technology [35]. However, the energy efficiency and sustainability of such buildings are not ideal and lack universality. Meanwhile, stagnant eco-tech is not a sustainable ecological view [36]. Therefore, consideration should be given to the application of modern ecological technology to ordinary architectural design, that is, "appropriate technology". "Appropriate technology" is a technology with certain suitability and universality, and ecological buildings that can have certain regional characteristics according to different environments should become the focus of research. That is to say, starting from meeting the requirements of the basic living environment, through the design method of "suitable technology", using local resources, and combining them with suitable economic technology, the ecological building design was carried out to achieve the purpose of sustainable development [37,38]. There are usually three ways to transform ecological building design from "original" to "appropriate technology": one is to transform traditional technology; the other is to reform and adjust advanced technology to meet the needs of suitable technology; work with appropriate technology.

When people measure the rationality of a new idea or technology, they often pay attention to whether its short-term benefits are significantly higher than those of traditional ideas or technologies [39,40]. If its short-term benefits are not optimistic, even if it has better long-term benefits, it will be difficult for people to accept; this may become a threshold for the promotion of ecological buildings based on the principles of sustainable development. In terms of the economy, eco-building is a type of project that requires more upfront costs and a relatively slow rate of benefit goals. More importantly, the return on investment in ecological facilities is not necessarily able to be put into the developer's pocket but is more shared by users and society, and it will take a few years to reflect the energy-saving [41]. The value is greater than the value of ecological construction investment, which may discourage policymakers and developers. The field of architecture calls for the concept of architectural design that breathes with the environment, advocates for the application of various architectural ecological technologies, and develops ecological architecture [42]. This not only contributes to the improvement of the quality of the global environment but also to the improvement of the quality of life of individuals [43,44]. In developing countries, increasing research on ecological buildings, promoting the ecological generation of buildings, and actively using appropriate technologies will have far-reaching practical significance from the perspective of the environment, energy, or architectural design [39,41].

2.4. Sustainable Architecture Evaluation

Architecture environmental assessment studies have developed methods to determine the degree of achievement of environmental goals to guide sustainable building planning and design processes [42,43]. That is, in the early stages of the construction process, planners can make decisions to improve building performance at very low or zero cost based on the recommendations of decision-making tools, the use of information and tools that can help designers and builders, and design strategies for their architectural projects [44].

Various assessment tools have been developed internationally that consider specific sustainable building users and meet special requirements. The development of global sustainable building assessment tools has become a research hotspot, with a focus on environmental protection issues. The sustainability assessment of old and new buildings can be optimized by using different assessment tools. The assessment systems include BREEAM in the UK, EEWH, and other assessment systems [14].

With the development of international standards and definitions in the field of Building Sustainability Assessment Methods (BSAM), more and more regions are considering other aspects of sustainable buildings, such as functionality, economy, ease of use, and technical features. It includes the various procedural stages of the building in its overall life cycle, that is, from the procurement of raw materials, the production of building materials and objects, the actual construction process of the building, and the use, maintenance, demolition, and final disposal stages [45]. Various methods and tools are available in the literature to assist this study in constructing the relative impact of different variables on sustainable building design and function, such as energy use during the operational phase, analyzing environmental impacts, examining daily lighting levels in rooms, and predicting overall building costs: life cycle and other or specific parameter combinations [46].

The purpose of this research is to construct sustainable building evaluation indicators suitable for Taiwan. Based on the above literature evaluation scope and content analysis, it was found that most evaluation tools cover issues such as the internal environment of the building, the area of the building base, and the surrounding environment of the building [45,47]. The purpose of this study is to further generalize and construct a sustainable campus ecological building index that is suitable for Taiwan's geographical characteristics and has a sustainable conceptual framework such as environmental, social, and economic aspects [17,45]. Taiwan is located on the southeast coast of the Asian continent and on the west coast of the Pacific Ocean, between Japan and the Philippines, and is located in the center of the East Asian island arc. It is warm throughout the year, with large changes in spring and winter among the four seasons and small changes in summer and autumn. The annual average temperature is about 22 °C, and the average minimum temperature is only 12–17 °C (54–63 °F).

3. Methodology

This research aims to construct an index of sustainable building levels in Taiwan. It summarizes the conceptual framework of the research based on the analysis results of the related literature discussion in the previous chapter and intends to use two research methods. The "Fuzzy Delphi Method" (FDM) and "The Fuzzy Analysis Hierarchical Procedures (FAHP) are used to construct the hierarchical indicators and confirm the indicator weights. The methodology flow chart is shown in Figure 1.

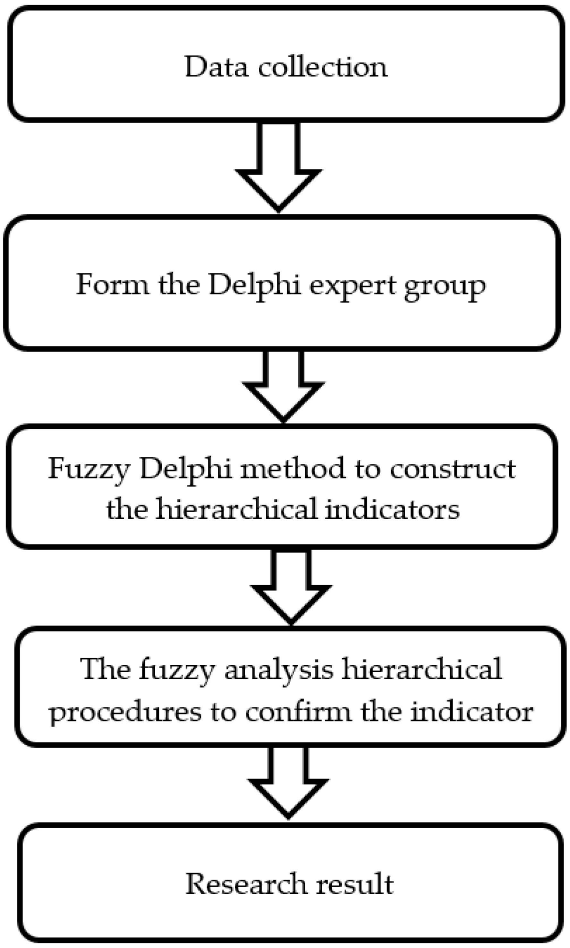

Figure 1. Research methodology flow chart.

3.1. Research Procedure

This research collects and summarizes campus sustainable ecological construction indicators and evaluation tools mentioned by relevant scholars at home and abroad by sorting out relevant literature to construct a preliminary index framework for sustainable ecological construction of Taiwan high school campuses. In the Fuzzy Delphi Expert Questionnaire, after answering the questionnaire, delete the unimportant factors, and obtain "The Hierarchical Structure of Sustainable Ecological Building Indicators in Taiwan High School Campus". According to the hierarchical index structure analyzed by the fuzzy Delphi method, the questionnaire design and implementation of the expert fuzzy analysis hierarchical process method are adopted. After answering the questionnaire, the relevant weighted results were summarized. Finally, relevant research suggestions are put forward for the operation or construction of sustainable ecological buildings on Taiwan high school campuses.

3.2. Fuzzy Delphi Method, FDM and Fuzzy Analysis Hierarchical Procedures, FAHP

The Delphi method, proposed by Dalkey and Helmer in 1960, is a procedural method for systematically expressing the opinions of expert groups. In addition, Murray, Pipino, and Gigch first combined fuzzy theory (fuzzy set) in the Delphi method. Ishikawa et al. have used the concept of cumulative number distribution and fuzzy integral to integrate the opinions of experts into fuzzy numbers, which was called the fuzzy Delphi method (FDM) [14,46]. The fuzzy Delphi method can be used as a screening tool for evaluation criteria. Compared with the traditional Delphi method, it has the following advantages: (1) reducing the number of investigations; (2) expressing the opinions of experts more completely; (3) through the fuzzy application of theory, expert knowledge will be more in line with rationality and needs and (4) more economical in terms of time and cost [47]. Generally, the fuzzy Delphi method can be used to carry out the following three main steps: (1) establishing an evaluation factor set that affects decision-making; (2) collecting the opinions of experts or decision-making groups, and (3) calculating the evaluation value of the fuzzy Delphi method. Therefore, this research follows this method to screen important product design evaluation criteria to achieve the objectives set up during the research so that the results obtained are more objective and practical. In the weight calculation program of the campus ecological building index, this research adopts the Fuzzy AHP research method to improve the research quality. Since the calculation of the Fuzzy AHP is more complicated than the traditional AHP, this research intends to use the professional FAHP analysis software—Power Choice. The results of the expert questionnaire were analyzed.

Power Choice software is a decision analysis tool that provides Fuzzy AHP. In the case of uncertainty or decision problems with most evaluation criteria, by establishing a hierarchical structure with interactive influence relationships, complex problems can be systematized, and quantitative judgment is used to evaluate, and then sufficient information is provided for decision-makers to make judgments, to ensure the reduction in decision-making risks, and the improvement of the accuracy of decision-making.

The FAHP method can calculate the fuzzy weight and relative importance of each element from the relative scores of the elements at each level assessed by experts and then determine the importance order of each sub-criteria for the overall evaluation hierarchy through hierarchical series connection. However, if you want to determine whether there is a mutual influence between certain two evaluation elements and the degree of influence, it is necessary to cooperate with data mining to determine the influence and correlation between the elements. This research uses traditional AHP to calculate the relative weight of each evaluation element in each questionnaire and then uses the fuzzy semantic scale variable table to convert the continuous relative weight data into intermittent fuzzy semantic data. Finally, each subject's intention can be used as the input parameter of FAHP analysis after the fuzzy semantic transformation, and useful association rules between the subcriteria can be found.

3.3. Participants

The analysis steps of the ANP are: (1) establish a problem structure, establish a decision problem, and establish a network hierarchy; (2) pairwise comparison of various aspects and standards; (3) convert the total impact of the standard into a total-importance relationship. At the same time, normalize and transpose the matrix to complete the unweighted matrix of the supermatrix; (4) carry out the finite supermatrix, and finally obtain the weight and order of each evaluation standard.

This study uses the Fuzzy Delphi method to test ecology and construction industry experts and publish a report on ecological campus buildings. Eight experts, four construction practitioners, and four university professors completed the fuzzy Delphi expert questionnaire for this study. All the questionnaires were recovered, and all were valid questionnaires. The answer period is January–February 2022. The background information of the experts is shown in Table 1.

Table 1. Expert background of FDM.

Type of Industry	Duty Position	Gender	Educational Background	Seniority
Company A	manager	F	Bachelor. Architecture	25–30 years
Company B	manager	M	Master. Engineering	10–15 years
Company C	manager	F	Ph.D. Management	10–15 years
Company D	CEO	M	Master. Interior space design	10–15 years
University A	professor	M	Ph.D. Architecture	10–15 years
University B	professor	M	Ph.D. Biology	10–15 years
University C	professor	M	Ph.D. Architecture	15–20 years
University D	professor	M	Ph.D. Architecture	15–20 years

3.4. Ecological Building Campus Substantial Environmental Assessment Framework

For the 27 evaluation factors belonging to the five evaluation index groups, the principles are established through the first-level fuzzy Delphi method according to the level of the analytic hierarchy process. Therefore, according to their classification and mutual independence, establish the level of the physical environment evaluation framework of the ecological building campus, and formulate the second-stage analytic hierarchy process expert questionnaire. Due to the high complexity of the AHP questionnaires, cross-comparisons are required. To avoid overly complicated questionnaire responses, which may lead to erroneous results, this study uses the selected items as evaluation factors and establishes the upper layer as an evaluation indicator. The content description of the additional items of the indicator is the basis for formulating the second-stage expert questionnaire. Its evaluation framework was designed to assess the physical environment of an ecological campus. Table 2 shows the details of establishing the hierarchy of objectives, evaluation indicator groups, evaluation indicators, and evaluation factors.

Table 2. Assessment index and assessment factor.

Research Dimension	Question of the Questionnaire
Campus' architectural space	1.Sustainable building materials
	2. Efficient space usage
	3. Building orientation
	4. Use of natural light
	5. Energy planning for buildings
Ecological environment of the campus	1. Organic education field
	2. Campus native plants
	3. Ecological education area
	4. Biological habitat
	5. Establishment of campus ecological database

Table 2. *Cont.*

	Research Dimension	Question of the Questionnaire
Taiwan Sustainable Eco-Campus Evaluation Index		1.Sustainable building materials
	Classroom environment quality	1. Classroom noise
		2. Classroom air quality
		3. Classroom lighting
		4. Ventilation system
		5. Temperature and humidity control
		6. PM2.5
	Energy and resource consumption	1. Renewable energy
		2. Solar energy utilization
		3. Campus Wind Power
		4. Energy-efficient buildings
		5. Water retention of building base
		6. Electromagnetic interference
	Functionality with durability	1. Healthy campus environment
		2. Sustainable innovation design method
		3. Eco-campus maintenance
		4. Building appearance maintenance
		5. Use of high-efficiency equipment

4. Results

The research motivation and purpose of this research require us to describe the research and analyze the results of the "Fuzzy Delphi Method" and "Fuzzy Analysis Hierarchical Procedure Method". The results of the two research methods are described below.

4.1. Fuzzy Delphi Analysis Results

The purpose of this study is to use the Fuzzy Delphi method to revise the hierarchical structure of the preliminary sustainable building evaluation indicators constructed by the literature discussion to make the theory and practice connotation consistent and evaluate the appropriateness and importance of indicators to develop a sustainable ecological building indicator framework that is more in line with the region. At this stage, the Fuzzy Delphi scale was divided into five main criterion types according to the interview results: 1. campus space architecture; 2. campus ecological environment; 3. classroom environmental quality; 4. energy and resource consumption; 5. functionality with durability.

This study solicited the opinions of experts in the ecology and construction industry and the issue of literature discussion and compilation and preliminarily formulated five dimensions and 27 evaluation factors of the ecological campus built environment index dimension and criterion factor. This study invited eight experts. They were invited to fill in the questionnaire (Table 1). All the questionnaires were recovered, and all were valid questionnaires. According to the 80/20 rule, multiply the overall average of 9.62 by 80% to obtain a threshold of 7.69. The lower ones were truncated, and all five dimensions were retained (see Table 3), so the measurement dimensions had expert consistency and importance. In addition, regarding the ecological campus built environment indicators, this research analyzes the evaluation factors of the ecological campus built environment indicators. The screening method used the 90% expert consensus value Gi9.54 as the threshold, and the expert consensus threshold was 8.82. The lower ones have been removed, leaving 25 evaluation criteria, as shown in Table 4.

Table 3. Dimensional analysis selection of ecological campus building factors.

Criteria	C^i		a^i		O^i		M^i			M^i	Z^i	M^i-Z^i	G^i
Dimension	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	C^i	a^i	O^i				
Campus' architectural space	8	9	9	10	9	10	8.42	9.42	9.87	1.44	0	1.44	9.62
Ecological environment of the campus	8	9	9	10	9	10	9.21	9.98	10	0.92	0	0.92	10
Classroom environment quality	8	10	9	10	10	10	8.76	9.77	10	1.22	0	1.22	10
Energy and resource consumption	8	9	9	10	9	10	8.54	9.55	10	1.33	0	1.34	10
Functionality with durability	8	9	9	10	10	10	8.57	9.54	9.89	1.21	0	1.22	9.02
Total				5				Threshold				8.69	

Table 4. Analysis and screening table of evaluation criteria.

Criteria	C^i		a^i		O^i		M^i			M^i	Z^i	M^i-Z^i	G^i
Dimension	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	C^i	a^i	O^i				
Sustainable building materials	7	9	8	9	9	10	7.64	8.53	9.52	1.50	0	2.88	8.38
Efficient space usage	7	9	7	8	8	9	7.00	7.89	9.00	2.00	−1	0	5
Building orientation	9	10	9	10	9	10	9.31	9.86	10.00	0.66	0	0.66	10.00
Use of natural light	7	8	8	9	9	10	7.78	8.65	9.64	1.88	−1	2.88	8.26
Energy planning for buildings	8	9	8	9	9	10	8.65	9.65	9.87	1.22	0	1.22	9.00
Organic education field	8	9	9	10	8	10	8.77	9.78	9.77	1.11	0	1.11	9.00
Campus native plants	9	10	9	10	10	10	9.85	10	10	0.14	0	0.12	10.00
Ecological education area	7	8	8	9	9	10	7.42	8.33	93.31	1.88	0	2.88	8.65
Biological habitat	7	8	8	9	9	9	7.31	8.20	9.20	1.50	−1	2.88	8.77
Establishment of campus ecological database	8	9	9	10	9	10	8.31	9.31	9.76	1.44	0	1.44	9.00
Classroom noise	7	8	8	9	9	10	7.64	8.65	9.65	2.00	0	3.00	8.34
Classroom air quality	7	8	8	9	8	9	7.00	8.00	8.88	1.89	−1	2.89	7.00
Classroom lighting	7	9	7	9	9	10	7.55	8.43	9.43	1.88	0	2.88	8.51
Ventilation system	9	10	9	9	9	10	9.76	10	10	1.45	0	1.45	10.00
Temperature and humidity control	7	8	7	6	7	8	7.23	7.31	8.76	1.46	−1	1.82	6.00
PM2.5	8	9	7	9	9	10	8.25	9.25	9.31	1.57	−1	2.57	9.00
Renewable energy	6	8	7	9	7	9	7.52	8.08	9.09	2.01	0	2.01	8.00
Solar energy utilization	8	9	9	10	9	10	8.22	9.23	9.82	1.57	0	1.57	9.00
Campus Wind Power	9	10	9	10	8	9	9.21	10	10	10	0	0.25	9.00
Energy-efficient buildings	9	10	8	10	9	10	9.55	10	10	0.45	0	0.45	9.00
Water retention of building base	8	9	9	10	8	10	8.35	9.22	9.76	1.62	0	1.55	9.00
Electromagnetic interference	6	8	7	8	7	8	6.99	7.78	8.63	1.65	−1	0.64	7.00
Healthy campus environment	8	9	8	10	8	9	8.34	9.24	9.25	1.58	0	1.50	9.00
Sustainable innovation design method	9	10	9	10	8	9	9.55	10	10	0.51	0	0.24	10.00
Eco-campus maintenance	9	10	10	10	8	10	9.44	10	10	0.56	0	0.56	10.00
Building appearance maintenance	8	10	8	9	8	9	9.35	8	9	1.55	1	0.42	9
Use of high-efficiency equipment	8	10	8	9	8	10	8.24	9	9	1.58	0	0.58	10
Total number of research dimensions selected				27				Threshold				8.82	

4.2. Fuzzy Analysis Hierarchical Procedure Method Results

After this research used the fuzzy Delphi method to screen and analyze the importance of the evaluation indicators of campus ecological buildings, this section intends to use the

25 evaluation indicators of campus ecological buildings summarized by this research to conduct an empirical study of the fuzzy analysis hierarchical procedure method, and its use by the government. It is a reference for the construction, maintenance, and related evaluation of campus ecological buildings by units or the construction industry. The data results calculated by Power Choice in this study were summarized as follows:

In Table 5, we can see the relative weights of the evaluation index factors of campus space buildings. Experts believe that efficient space utilization is the top priority for the overall development of campus space buildings, followed by building positioning and natural light utilization. The building energy planning has a lower weight, the consistency CI value of the main floor is 0.016246, and the CR value is 0.013286, both of which are less than 0.1, indicating good consistency. Relative weights of the evaluation index factor for the ecological environment of the campus. Experts believe that the environmental education area is the top priority for the overall development of the ecological environment of the campus, followed by the biological habitat and the organic education field.

Table 5. Relative weights of the evaluation index factors of campus space buildings.

	Research Dimension	Question of the Questionnaire	Weighting	Ranking
Taiwan Sustainable Eco-Campus Evaluation Index	Campus' architectural space	1.Sustainable building materials	0.142481	4
		2. Efficient space usage	0.178253	1
		3. Building orientation	0.163466	2
		4. Use of natural light	0.158852	3
		5. Energy planning for buildings	0.116571	5
		λmax = 5.170784, C.I = 0.016246, C.R = 0.013286		
	Ecological environment of the campus	1. Organic education field	0.051396	3
		2. Campus native plants	0.043268	4
		3. Ecological education area	0.065325	1
		4. Biological habitat	0.059228	2
		5. Establishment of campus ecological database	0.031554	5
		λmax = 4.383225, C.I = 0.013951, C.R = 0.011272		
	Classroom environment quality	1. Classroom noise	0.028698	2
		2. Classroom air quality	0.023596	4
		3. Classroom lighting	0.031227	1
		4. Ventilation system	0.021447	5
		5. PM2.5	0.026557	3
		λmax = 4.125247, C.I = 0.015239, C.R = 0.014841		
	Energy and resource consumption	1. Renewable energy	0.031547	3
		2. Solar energy utilization	0.026583	5
		3. Campus Wind Power	0.028631	4
		4. Energy-efficient buildings	0.034553	2
		5. Water retention of building base	0.037582	1
		λmax = 5.98581, C.I = 0.02917, C.R = 0.02331		
	Functionality with durability	1. Healthy campus environment	0.034223	3
		2. Sustainable innovation design method	0.036874	2
		3. Eco-campus maintenance	0.039531	1
		4. Building appearance maintenance	0.029831	4
		5. Use of high-efficiency equipment	0.026553	5
		λmax = 6.139546, C.I = 0.020351, C.R = 0.018261		

The establishment of the campus ecological database has a lower weight, the consistency CI value of the main layer is 0.013951, and the CR value is 0.011272, all of which are less than 0.1, indicating good consistency.

The relative weights of the classroom environment quality indicator factors are indicated. Experts believe that classroom lighting is the top priority for the overall development of the classroom environment quality, followed by classroom noise and PM2.5. The ventilation system has a lower weight. The consistency CI value of the main layer is =0.015239, and the CR value is 0.014841, both of which are less than 0.1, indicating good consistency.

The relative weights of energy and resource consumption indicator factors are indicated. Experts believe that the water retention of building bases is the top priority of the overall development of energy and resource consumption, followed by energy-efficient buildings and renewable energy. Solar energy utilization has a low weight. The consistency CI value of the main layer is 0.02917, and the CR value is 0.02331, both of which are less than 0.1, indicating good consistency.

The relative weights of functionality with durability indicator factors are indicated. Experts believe that eco-campus maintenance is the top priority of the overall development of functionality with durability, followed by sustainable innovation design methods and a healthy campus environment. The use se of high-efficiency equipment with lower weights: the consistency CI value of the main layer is 0.020351, and the CR value is 0.018261, both of which are less than 0.1, indicating good consistency.

4.3. Overall Analysis of Weight Results of Campus Ecological Building Evaluation Indicators

In this study, the FAHP expert questionnaire was analyzed for the campus ecological building evaluation model. After the FAHP weight calculation, this study analyzed and compared all evaluation items of the hierarchical campus ecological building structure so as to understand the importance of the campus ecological building evaluation model for high schools in Taiwan shown in Table 6.

Table 6. Evaluation model of ecological building in Taiwan high school campus.

Ranking	Question of the Questionnaire	Weighting	Research Dimension
1	Efficient space usage	0.178253	Campus' architectural space
2	Building orientation	0.163466	Campus' architectural space
3	Use of natural light	0.158852	Campus' architectural space
4	Sustainable building materials	0.142481	Campus' architectural space
5	Energy planning for buildings	0.116571	Campus' architectural space
6	Ecological education area	0.065325	Ecological environment of the campus
7	Biological habitat	0.059228	Ecological environment of the campus
8	Organic education field	0.051396	Ecological environment of the campus
9	Campus native plants	0.043268	Ecological environment of the campus
10	Eco-campus maintenance	0.039531	Functionality with durability
11	Water retention of building base	0.037582	Energy and resource consumption
12	Sustainable innovation design method	0.036874	Functionality with durability
13	Energy-efficient buildings	0.034553	Energy and resource consumption
14	Healthy campus environment	0.034223	Functionality with durability
15	Establishment of campus ecological database	0.031554	Ecological environment of the campus
16	Renewable energy	0.031547	Energy and resource consumption

Table 6. *Cont.*

Ranking	Question of the Questionnaire	Weighting	Research Dimension
17	Classroom lighting	0.031227	Classroom environment quality
18	Building appearance maintenance	0.029831	Functionality with durability
19	Classroom noise	0.028698	Classroom environment quality
20	Campus Wind Power	0.028631	Energy and resource consumption
21	Solar energy utilization	0.026583	Energy and resource consumption
22	PM2.5	0.026557	Classroom environment quality
23	Use of high-efficiency equipment	0.026553	Functionality with durability
24	Classroom air quality	0.023596	Classroom environment quality
25	Ventilation system	0.021447	Classroom environment quality

4.4. Analysis of Campus Ecological Building Indicators

This research selects the first five important indicators for exploration and shows the evaluation mechanism of experts on campus ecological buildings to achieve the goal of a sustainable ecological campus.

(1) Efficient space usage

The campus is a base for guiding imagination and creativity, a space for exploring the unknown and experience, a field for learning and thinking, a hall for guiding the development of personality and values, and a place for the enlightenment of humanistic qualities [48]. Every campus is the most convenient educational base for implementing environmental teaching. On-campus, there is an understanding of the ecological laws of interdependence, symbiosis, co-prosperity between living things, between people and the living environment, and between people and energy resources [48]. The transformation of the environment not only looks at the individual but also looks at the relationship between the individual and the environment, focusing on creating the relevance of each part and the relationship between them in a perpetual cycle [49]. The focus of sustainable campus transformation is to change people's thinking and behavior and to promote education as the main purpose of space transformation.

(2) Building orientation

The orientation of campus buildings should take natural conditions into account, such as air, sunlight, orientation, and field of vision. In terms of configuration, systematic and hierarchical planning and designed are carried out from large to small, and all classrooms are mainly oriented in the north-south direction as much as possible to maximize the building's energy-saving effect [50]. Under the climatic conditions of Taiwan, the north-south school building configuration is the most natural. In the past, most of the campus configurations were north-south school buildings, which were often configured in a one-line or a mouth shape, but the purely north-south campus space was monotonous and rigid, and the mouth-shaped and E-shaped campuses were uniformly distributed on campus at all levels. Additionally, the base orientation is not necessarily north-south; each base fulfills its responsibilities and strives for the permeation and greening of every inch of land so that the earth can breathe and the environment is very ecologically friendly; then the goal of a sustainable ecological campus is not far away [51].

(3) Use of natural light

The best light source is natural light, and the same is true in campus buildings, which is why the lighting design of green buildings should allow natural light to enter the interior. This is not only energy saving, but this kind of light is better for the human eyes and body, and it can also affect the effect of learning for students [52].

(4) Sustainable building materials

Not all artificial light sources used in buildings can achieve the benefits of natural light. If the artificial light source is not well designed, it will cause the problem of glare, which will affect the vision, damage the eyesight and affect the comfort of the eyes. Therefore, the source of light in the planning of ecological campus buildings is an important factor that must be considered [52,53]. The lighting needs of many events can be met as long as diffused light enters the campus space. As a result, students hardly need to turn on the lights most of the time they are engaged in indoor learning activities [54].

(5) Energy planning for buildings

Buildings are the largest energy consumers, consuming between one-quarter and one-third of the world's total energy consumption and releasing greenhouse gases. In response to the trends of energy conservation, carbon reduction, and sustainable environmental protection, governments around the world have included building energy conservation as critical to energy conservation and carbon reduction [55]. It is hoped that the goal of reducing carbon dioxide emissions and reducing energy consumption can be achieved through the implementation of building energy-conservation and carbon-reduction standard systems or the implementation of green buildings. Most buildings in China were not constructed after the careful consideration of the reasons for building energy consumption in the early stage of planning, resulting in many buildings with high-energy consumption and high carbon emissions [56,57]. Therefore, if the total energy consumption of building products can be reduced, and the practice of zero energy consumption and carbon neutrality can be achieved, it will effectively reduce the total energy consumption and achieve the goal of a low-carbon ecological campus [58].

5. Discussion and Conclusions

The findings suggest that the use of space for schools should be considered first. For example, new buildings must conform to the space used by students in teaching; in particular, attention should be paid to the orientation of the overall space and the ease of use of space for students in the school and must comply with the Energy Conservation Law and be affixed with energy-saving signs. These measures are essential to reduce energy consumption and sources of natural light [59]. In addition, campus ecological buildings should be integrated into school classroom activities. Energy-saving competitions can also be held in conjunction with local, sustainable education activities, such as energy-saving innovations, energy-efficient design, and environmentally-friendly living practices to encourage teachers and students to maintain sustainable campuses and foster the concept of environmentally sustainable education [60]. This study divided the 27 final initiatives identified in the literature into five main dimensions and 25 sub-dimensions. Some of the content is similar to other studies. However, differences in policy and management are evident: countries build their assessment tools according to their unique needs. The indicators in this study, although fundamental and regional, are local. Therefore, this study compares green procurement, management policies, and daily life behaviors across countries. Since Taiwan is an island country with scarce natural resources, energy-saving is more important than in other countries. Policy advocacy should be comprehensive, in-depth, and effective, and sometimes combined with appropriate and substantive incentives to raise the willingness to implement education in schools. Build a sustainable ecological campus that recycles resources and energy.

The problem with environmental sustainability is not a problem of insufficient resources but that we always want too much more than we need; it is a problem of allocation and cognitive responsibility; about 80% of the world's resources are owned by 15% of the world's depleted population. The means to make people consciously look at the resources they have and then recognize that they are shared by all of the creatures on the earth, and not at their discretion, is through guidance and education. Schools and families are the most important areas of life for children, and they are also places of enlightenment for personality development and value learning. Schools play very important roles. In promoting a sustainable ecological campus, the most important thing should be how to let teachers and students establish the concept of a sustainable environment and how to truly implement the environmental education of sustainable campuses. Let teachers and students establish correct environmental ethics, which is the most important thinking. From the perspective of sustainability, the environmental literacy of modern citizens is a comprehensive concern for human development, care for the conservation of the ecological environment, maintenance of social and cultural development, and adequate care for vulnerable social welfare [59,61]. Cultivating students to establish an all-around caring attitude of "caring about the future environment" is the ultimate goal of promoting sustainable campus plans. The specific and feasible approach of the school is when implementing the sustainable campus plan, in addition to building hardware facilities on the concept of sustainable development, while planning the hardware facilities, it can set up a teaching research team and plan related teaching plans. When building hardware facilities, the teaching team can cooperate with the development of teaching modules and perform teaching tests. When the renovation plan of the campus hardware facilities is completed, the research and teaching team can conduct practical teaching and assist in the operation and maintenance of the sustainable campus [62].

However, the new materials or new construction methods used in sustainable building ecological campuses are still not 100% free from pollution problems, and the calculation methods of benefits and environmental costs are still difficult to evaluate. Sustainable architecture is a road that is constantly being explored and revised. However, this road was not necessarily driven by technology [37]. One of the ways that human beings can help the environment is to revise their way of life so as not to waste materials excessively [63]. Pursuing comfort, reducing energy dependence, etc., is the part that needs to be practiced the most before exploring sustainable architecture.

Author Contributions: All authors contributed meaningfully to this study. C.-W.L., T.-W.C. and J.-H.L.—research topic; C.-W.L. and T.-W.C.—data acquisition and analysis; T.-W.C. and J.-H.L.—methodology support; C.-W.L., T.-W.C. and J.-H.L.—original draft preparation; C.-W.L., J.-H.L. and T.-W.C.—writing review and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Emmanuel, A.; Nicholas, A. What is extracted from earth is gold: Are rare earths telling a new tale to economic growth? *J. Econ. Stud.* **2018**, *45*, 177–192. [CrossRef]
2. Tiwari, S.; Dambhare, A.; Tripathi, R. Eco-Friendly Practices in Star Category Hotels of Lucknow: An Exploratory Study. *AVAHAN J. Hosp. Tour.* **2020**, *8*, 9–16.
3. Brown, L.R. Eco-Economy: Building an Economy for the Earth. *Manag. Environ. Qual. Int. J.* **2003**, *14*, 159. [CrossRef]
4. Velsey, K. Eco-friendly expense: The high cost of earth-friendly practices and the proliferation of plastic are added hurdles for reopening restaurants. *Crain's N. Y. Bus.* **2020**, *36*, 3.
5. MacKinnon, G.R.; MacKenzie, C. Take the Eco-Challenge. *Sci. Child.* **2005**, *42*, 18–21.
6. Luca, M.; Laura, P.; Marija, C.; Luca, C. Consumer appreciation of a shark-free eco-label for small pelagics. *Br. Food J.* **2021**, *123*, 88–104. [CrossRef]
7. Newberry, P.; Harper, P.; Morgan, T. Understanding the Market for Eco Self-Build Community Housing. *Sustainability* **2021**, *13*, 11823. [CrossRef]
8. Dunk, J. Psychology as if the whole earth mattered: Nuclear threat, environmental crisis, and the emergence of planetary psychology. *Hist. Psychol.* **2021**, *25*, 97–120. [CrossRef]
9. Flikkema, P.G. Cyber-Eco Technology: Engineering of Ecological Systems [Point of View]. *Proc. IEEE* **2013**, *101*, 1031–1033. [CrossRef]

10. Lee, S.; Tae, S.; Roh, S.; Kim, T. Green Template for Life Cycle Assessment of Buildings Based on Building Information Modeling: Focus on Embodied Environmental Impact. *Sustainability* **2015**, *7*, 16498–16512. [CrossRef]
11. Jehan, Z. An eco asset ontology towards effective eco asset management. *Built Environ. Proj. Asset Manag.* **2017**, *7*, 388–399. [CrossRef]
12. Jeziorski, A.; Therriault, G. Students' Relationships to Knowledges, Place Identity and Agency Concerning the St. Lawrence River. *J. Curric. Stud.* **2019**, *51*, 21–42. [CrossRef]
13. Santiago, J.A.; Pitta, D.A. Marketing from the end of the earth: the dilemma of Puerto Nativo Lodge. *J. Prod. Brand Manag.* **2011**, *20*, 141–146. [CrossRef]
14. Mohammed, A.B. Sustainable design strategy optimizing green architecture path based on sustainability. *HBRC J.* **2021**, *17*, 461–490. [CrossRef]
15. Wasley, J. Safe Houses and Green Architecture: Reflections on the Lessons of the Chemically Sensitive. *J. Archit. Educ.* **2000**, *53*, 207–215. [CrossRef]
16. Arend, M. Land Stewardship Is Key to a Future Innovation Park. *Site Sel.* **2021**, *66*, 38–42.
17. Grover, R.; Emmitt, S.; Copping, A. Sustainable development and architectural practice: Framing strategic approaches in the United Kingdom. *Sustain. Dev.* **2019**, *27*, 377–387. [CrossRef]
18. Mortada, H. Sustainable Desert Traditional Architecture of the Central Region of Saudi Arabia. *Sustain. Dev.* **2016**, *24*, 383–393. [CrossRef]
19. Mason, K. Justice in Building, Building in Justice: The Reconstruction of Intragenerational Equity in Framings of Sustainability in the Eco-Building Movement. *Environ. Values* **2014**, *23*, 99–118. [CrossRef]
20. Barthel, P.A. Morocco in the era of eco-urbanism: Building a critical and operational research on an emerging practice in Africa. *Smart Sustain. Built Environ.* **2016**, *5*, 272–288. [CrossRef]
21. Qiu, H.P. Great significance of innovative research on capital for building socialist political economics with Chinese characteristics. *China Political Econ.* **2020**, *3*, 329–340. [CrossRef]
22. Teh, D.; Corbitt, B. Building sustainability strategy in business. *J. Bus. Strategy* **2015**, *36*, 39–46. [CrossRef]
23. Yang, H.X.; Lou, C.Z.; An, D.W. The design and performance monitoring of an eco-building: A case study in Hong Kong. *Int. J. Low Carbon Technol.* **2006**, *1*, 59–68. [CrossRef]
24. Acharya, K.P.; Devkota, G.P.; Dhakal, K.P. Small Change Is Beautiful: Exploring Possibilities of Eco-San on School Garden for Transformative Pedagogy. *High. Educ. Stud.* **2020**, *10*, 122–132. [CrossRef]
25. Palanisamy, R. Strategic information systems planning model for building flexibility and success. *Ind. Manag. Data Syst.* **2005**, *105*, 63–81. [CrossRef]
26. Pickerill, J. Cold Comfort? Reconceiving the Practices of Bathing in British Self-Build Eco-Homes. *Ann. Assoc. Am. Geogr.* **2015**, *105*, 1061–1077. [CrossRef]
27. Mininni, G.M. The Barefoot College 'eco-village' approach to women's entrepreneurship in energy. *Environ. Innov. Soc. Transit.* **2022**, *42*, 112–123. [CrossRef]
28. Belmeziti, A.; Cherqui, F.; Tourne, A.; Granger, D.; Werey, C.; Le Gauffre, P.; Chocat, B. Transitioning to sustainable urban water management systems: How to define expected service functions? *Civ. Eng. Environ. Syst.* **2015**, *32*, 316–334. [CrossRef]
29. Newsome, D.; Sanguinetti, A.; Alavosius, M.P. Bringing Behavior-Analytic Theory to Eco-driving Research: Verbal Rules Mediate the Effectiveness of Feedback for Professional and Civilian Drivers. *Behav. Soc. Issues* **2021**, *30*, 612–631. [CrossRef]
30. Sabnis, V.; Kulkarni, S.S.; Gurav, S. NETRA Model at Rajarambapu Institute of Technology (RIT): Transform Engineering Campus into Product Innovation Centre–Journey so far. *Proc. Comput. Sci.* **2020**, *172*, 98–105. [CrossRef]
31. Grey, F.A. Masdar City as a Prototype for Eco-Cities. *Dig. Middle East Stud.* **2018**, *27*, 261–277. [CrossRef]
32. Bhakar, V.; Kumar, D.N.S.H.; Sai, N.K.; Sangwan, K.S.; Raghuvanshi, S. Life Cycle Assessment of Filtration Systems of Reverse Osmosis Units: A Case Study of a University Campus. *Proc. CIRP* **2016**, *40*, 268–273. [CrossRef]
33. Haley, D. A Walk on the Wild Side: Steps towards an ecological arts pedagogy. *Int. J. Educ. Art* **2021**, *17*, 135–152. [CrossRef]
34. Isaac, G.; Persad, U. Investigating the Haircare Product Manufacturing Industry in Trinidad and Tobago. *West Indian J. Eng.* **2019**, *42*, 33–38.
35. Morris, N.A. Education for Sustainability in the Parks: A Project Inspired by Chet Bowers. *Educ. Stud.* **2019**, *55*, 563–581. [CrossRef]
36. Moon, W.; Florkowski, W.J.; Brückner, B. Willingness to pay for environmental practices: Implications for eco-labeling. *Land Econ.* **2002**, *78*, 88–102. [CrossRef]
37. Kronenberg, J.; Andersson, E.; Barton, D.N.; Borgström, S.T.; Langemeyer, J.; Björklund, T.; Haase, D.; Kennedy, C.; Koprowska, K.; Łaszkiewicz, E.; et al. The thorny path toward greening: Unintended consequences, trade-offs, and constraints in green and blue infrastructure planning, implementation, and management. *Ecol. Soc.* **2021**, *26*, 36. [CrossRef]
38. Pagani, F. The Inheritance of Millennial Students: What Will They Inherit from Their Campus Experience and Consequently What Legacy Will They Leave the Next Generation? *Plan. High. Educ.* **2008**, *37*, 49–58.
39. Sehnem, S.; Martignago, G.; Pereira, S.C.F.; Jabour, C.C. Sustainable Management at a University in Light of Tensions of Sustainability Theory. *Rev. Adm. Contemp.* **2019**, *23*, 182–206. [CrossRef]
40. Danis, J.; Thurnquist, A. Lighting Demands in Green Schools. *Am. Sch. Univ.* **2011**, *83*, 36–39.

41. Stojanović, I.; Puška, A.; Osmanović, N.; Maksimović, A. Effects of Price Competitiveness on Tourism Performance Under Different Economic Conditions. *Tourism* **2021**, *69*, 543–558. [CrossRef]
42. Wang, J.; Ma, F.; Bouri, E.; Zhong, J. Volatility of clean energy and natural gas, uncertainty indices, and global economic conditions. *Energy Econ.* **2022**, *108*, 105904. [CrossRef]
43. Salisu, A.A.; Gupta, R.; Bouri, E.; Ji, Q. Mixed-frequency forecasting of crude oil volatility based on the information content of global economic conditions. *J. Forecast.* **2022**, *41*, 134–157. [CrossRef]
44. Nath, B.R.; Das, P. Role of socio economic conditions on students' education. *Clar. Int. Multidiscip. J.* **2019**, *8*, 56–61. [CrossRef]
45. Retzlaff, R. Green Building Assessment Systems: A Framework and Comparison for Planners. *J. Am. Plan. Assoc.* **2008**, *74*, 505–519. [CrossRef]
46. Häkkinen, T. Assessment of indicators for sustainable urban construction. *Civ. Eng. Environ. Syst.* **2007**, *24*, 247–259. [CrossRef]
47. Kokai, A.; Iles, A.; Rosen, C.M. Green Design Tools: Building Values and Politics into Material Choices. *Sci. Technol. Hum. Values* **2021**, *46*, 1139–1171. [CrossRef]
48. Arana, M.M.; Wittek, R.P.M. Community resilience: Sustained cooperation and space usage in collective housing. *Build. Res. Inf.* **2016**, *44*, 764–774. [CrossRef]
49. Kovalcik, J.; Villalobos, M. Automated Storage & Retrieval System: From Storage to Service. *Inf. Technol. Libr.* **2019**, *38*, 114–124. [CrossRef]
50. Alshuhail, K.; Taleb, H. Thermal performance and experimental assessment of building orientations in the United Arab Emirates (UAE). *Sci. Technol. Built Environ.* **2020**, *26*, 1461–1489. [CrossRef]
51. Albatayneh, A.; Alterman, D.; Page, A.; Moghtaderi, B. The Significance of the Orientation on the Overall buildings Thermal Performance-Case Study in Australia. *Energy Proc.* **2018**, *152*, 372–377. [CrossRef]
52. Oh, S.-T.; Lim, J.-H. Development and effect analysis of circadian rhythm-assisted LED lighting for reproducing short-wavelength ratio characteristics of natural light. *Int. J. Electr. Eng. Educ.* **2021**, *1*. [CrossRef]
53. Khmelinskii, I.; Makarov, V. Intermediate filaments in the retinal Müller cells as natural light energy guides. *J. Photochem. Photobiol. B Biol.* **2021**, *200*, 111641. [CrossRef] [PubMed]
54. Bailie, C.L.; Ball, M.E.E.; O'Connell, N.E. Influence of the provision of natural light and straw bales on activity levels and leg health in commercial broiler chickens. *Animal* **2013**, *7*, 618–626. [CrossRef]
55. Arizzi, A.; Brümmer, M.; Martín-Sanchez, I.; Cultrone, G.; Viles, H. The Influence of the Type of Lime on the Hygric Behaviour and Bio-Receptivity of Hemp Lime Composites Used for Rendering Applications in Sustainable New Construction and Repair Works. *PLoS ONE* **2015**, *10*, e0125520. [CrossRef]
56. Platnieks, O.; Barkane, A.; Ijudina, N.; Gaidukova, G.; Thakur, V.K.; Gaidukovs, S. Sustainable tetra pak recycled cellulose/Poly(Butylene succinate) based woody-like composites for a circular economy. *J. Clean. Prod.* **2020**, *270*, 122321. [CrossRef]
57. Izanloo, M.; Noorollahi, Y.; Aslani, A. Future energy planning to maximize renewable energy share for the south Caspian Sea climate. *Renew. Energy Int. J.* **2021**, *175*, 660–675. [CrossRef]
58. Sperling, K.; Arler, F. Local government innovation in the energy sector: A study of key actors' strategies and arguments. *Renew. Sustain. Energy Rev.* **2020**, *126*, 109837. [CrossRef]
59. Ozdemir, Y.; Kaya, S.K.; Turhan, E. A scale to measure sustainable campus services in higher education: "Sustainable Service Quality". *J. Clean. Prod.* **2020**, *245*, 118839. [CrossRef]
60. Chen, C.-W.; Wang, J.-H.; Wang, J.C.; Shen, Z.-H. Developing indicators for sustainable campuses in Taiwan using fuzzy Delphi method and analytic hierarchy process. *J. Clean. Prod.* **2018**, *193*, 661–671. [CrossRef]
61. Higgins-Desbiolles, F.; Moskwa, E.; Wijesinghe, G. How sustainable is sustainable hospitality research? A review of sustainable restaurant literature from 1991 to 2015. *Curr. Issues Tour.* **2019**, *22*, 1551–1580. [CrossRef]
62. Finlay, J.; Massey, J. Eco-campus: Applying the ecocity model to develop green university and college campuses. *Int. J. Sustain. High. Educ.* **2012**, *13*, 150–165. [CrossRef]
63. Bruno, J.E.; Fernandez-Gimenez, M.E.; Balgopal, M.M. An integrated livelihoods and well-being framework to understand northeastern Colorado ranchers' adaptive strategies. *Ecol. Soc.* **2021**, *26*, 675–694. [CrossRef]