

Creating a Environmental Sustainable Design Practices Case Bank: Integrating Industry and Teaching at the Threshold

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Abstract

This paper starts from the problem of sustainable design research case resource construction, takes the integration of industry and education as the threshold, applies the principle of system theory, and synthesizes the multi-disciplinary research methods of design science and other disciplines, to explore the significance and ways of constructing the construction of the teaching case base of “Sustainable Design Practice”. By choosing diverse teaching cases of sustainable design practice, we aim to cultivate students’ understanding of interdisciplinary research cognitive methodology and the laws and logic of sustainable design, in order to better connect with the development of local design industry. This paper elaborates on the construction of teaching case library, forming “two objectives” and “three major teaching case groups” centered on building practical ability. At the same time, the joint participation of off-campus tutors and enterprise practice tutors in the construction and teaching of the case library promotes the close integration of industry, academia and research in the environmental design specialty.

Keywords

Industry-Teaching Integration, Teaching Case Base, Construction, Environmental Design

1. Introduction

Industry-education integration is a process in which higher education institutions integrate deeply with the industry in order to meet the talent cultivation goals, and construct the curriculum system based on the needs of the industry and enterprises, which embodies the two-way integration of academics and

practice, and provides a driving force for the optimization of the curriculum system of the environmental design profession in higher education (Ma & En, 1975). In this model, the industrial demand should be the core driving force of teaching, while the teaching case base is its concrete realization, and its content should be continuously optimized according to the industrial demand to ensure the close integration of education and industry. Sustainable Design Practice is a practical strategy course for current global habitat issues, which is based on the principles of habitat science, discusses the core theories of sustainable design in depth, and seeks solutions to practical problems (Zheng, 2010). In order to meet the education and talent needs of Guangdong, Hong Kong and Macao Bay Area, it is recommended to build a teaching case base of Sustainable Design Practice that matches the needs of social development, so as to adapt to the national strategy of science and education and the policy of integration of industry and education (Zhou, 2011).

This paper has the following three innovations: 1) By integrating systems theory with interdisciplinary methods from design science, this research delves deeply into the significance and methodologies of constructing a teaching case bank on “Sustainable Design Practice” from an industry-education integrated perspective, offering fresh avenues for sustainable design case resource construction; 2) The establishment of “two primary objectives” and “three major teaching case clusters” centered on practical capability encapsulates cases from various domains and industries of sustainable design practice, thereby fostering a more intimate confluence of industry, academia, and research within the realm of environmental design; 3) Tailoring to the specific talent development needs and regional economic characteristics of the Guangdong, Hong Kong, and Macao Greater Bay Area, a comprehensive strategy has been articulated to optimize the relevance and applicability of the teaching case bank. This not only ensures alignment with the talent cultivation requisites of the Greater Bay Area but also serves as an enlightening paradigm for educational practices both within Guangdong province and nationwide.

2. Methodology

2.1. The Significance of Building a Casebook for Teaching Sustainable Design Practice

To achieve the purpose of talent quality enhancement and to provide case base support for the strategy of adapting to the talent needs of the Guangdong-Hong Kong-Macao Greater Bay Area. Through the construction of the Teaching Case Bank of Sustainable Design Practice, the strategic ideas of the Outline of the Plan for the Development of Guangdong, Hong Kong and Macao Bay Area are organically combined with the construction of the Teaching Case Bank to provide richer and more practical teaching resources, and to provide teaching contents that are closer to the practice, so as to enhance the effectiveness of teaching and improve the quality of teaching (Bi & Shi, 2021).

Build a teaching case library that is in line with the same type of courses on campus and off campus, and realize the sharing. The teaching casebook of Sustainable Design Practice is a selection of research cases that are authentic, typical, objective, current and innovative. In view of the cross-disciplinary nature of the course, the selected cases are also applicable to the courses of “Topics in Interior Environmental Design”, “Urban and Rural Renewal and Rural Design”, “Regional Culture and Design Development”, and “Design Paradigms and Innovations”, so as to promote their comprehensive application in multiple courses (Victor, 2013). In addition, the case bank is intended to be connected with the corresponding courses of other universities and to realize resource sharing within a certain scope, so as to promote the innovation of the education training mode, which reflects the macroscopic value of the teaching case bank of “Sustainable Design Practice”.

Constructing multi-level sustainable design cases and implementing different ways of selecting and combining knowledge materials. By consolidating students’ knowledge of the sustainable structural framework, reorganizing the knowledge material of the cases, and guiding the scientific elaboration of the complexity and contradictions of sustainable design practice and design culture by combining different research foci with different forms of research tools.

In order to alleviate the tension in the supply of composite talents, this study aims to provide the support and intellectual capital of a teaching case base for industry-teaching integration. By thoroughly exploring the relationship and driving mechanism between the teaching case base and the integration of industry and education, cooperation among schools, cooperation between schools and enterprises, and cooperation between schools and associations, this study aims to provide students with practical cases and experiences that are more closely related to the industry (Li, 2006). In addition, it creates more opportunities for enterprises to participate in education and training and realize collaborative education. The study also further explores a cooperative system of industry-education integration and teaching casebook intervention with characteristics of the Guangdong-Hong Kong-Macao Greater Bay Area, in order to respond more effectively to the challenges of composite talent supply.

2.2. An Overview of Building a Teaching Case Bank for Sustainable Design Practice at Home and Abroad

In China, universities have begun to experiment and practice the case base for teaching Sustainable Design Practice. The School of Architecture and Urban Planning at Shanghai Jiao Tong University has created a resource called “Sustainable Design and Urban Development Case Bank”, which covers cases of architectural and environmental design. Meanwhile, the China Academy of Building Research (CABR) has created the “China Green Building Design and Technology Promotion Database”, which focuses on the research of sustainable building technologies and green building standards (Hua et al., 2019). It is worth noting that Beijing Forestry University started to build a teaching case base for

Sustainable Design Practice as early as 2019, aiming to assist students in understanding and practicing the core concepts and methods of sustainable design through actual cases. In addition, the China Academy of Art also continues to explore and practice in the field of sustainable design education, and has developed its teaching casebook accordingly (Ma & Du, 2022).

Internationally, numerous institutions of higher education are increasingly emphasizing partnerships with business, valuing synergistic interdisciplinary efforts and placing special emphasis on the importance of practice-based curricula. Harvard University, for example, has created a global health services casebook designed to publicize outstanding practices in global health and provide a rich resource for medical and public health education. The Massachusetts Institute of Technology and the University of California have created pedagogical casebooks on sustainable urbanization and sustainable development, respectively, covering a wide range of disciplines, including architecture, the environment, agriculture and public health, in order to help students develop a deeper understanding and practice of the core concepts of sustainability. The Queensland University of Technology (QUT) in Australia, on the other hand, has a case bank that focuses on real-world problems in business and encourages students to solve these problems through practice. In addition, the U.S. Department of Environmental Planning of the United Nations and the Royal Institute of British Architects have respectively set up best practices and example libraries of sustainable architecture, which bring together cases of sustainable architecture from around the world. These case libraries not only provide rich resources for academia, but also have a profound impact on industry-academia-research cooperation, talent cultivation and social progress.

Compared with developed countries in Europe and the United States, the construction of the teaching case base of Sustainable Design Practice in China's undergraduate education is still in the primary mode of school-enterprise cooperation, and fails to realize the in-depth integration of industry and education. This is mainly reflected in the following points: firstly, the construction of the teaching case base of Sustainable Design Practice has not been widely carried out in China, and only a few higher education institutions, research institutes and enterprises have carried out preliminary exploration and practice. Secondly, the current research on teaching case base is not deep enough, and the course cooperation relationship with enterprises is unstable and the cooperation content lacks depth. Nevertheless, with the continuous promotion and practice of sustainable design thinking, it is expected that the construction of teaching case base will gradually receive wider attention and support in the context of industry-education integration.

3. Prospects for the Application of Building a Casebook for Teaching Sustainable Design Practice

From the perspective of industry-education integration, this study adopts the principles of systematics and combines the multidisciplinary approaches of de-

sign, history, sociology, anthropology, architecture and landscape architecture to construct a teaching case library for Sustainable Design Practice. The library aims to guide students to think deeply about sustainable design, identify classic cases, and promote the integration from practical needs to the wisdom of design culture, and then adhere to the professionalism of serving the country, people and ecological environment. Typical cases reflect the rational thinking of designers, and through the interpretation of these cases, the study demonstrates a systematic perspective from case writing to innovative expression.

In the context of industry-education integration, this study conducted an in-depth review of the teaching casebook of Sustainable Design Practice, combed through the relevant literature, categorized the case information, and synthesized the sustainable design practice in an authoritative way. In the case study, the research considers the heritage, integration and universality of design, while focusing on the full life cycle of design, vertically examining its historical development, horizontally conducting a comparative study between East and West, and always emphasizing the subjective initiative of human beings.

At the application level, for students, the pedagogical case bank can facilitate the development of their practical skills and enhance the interface with vocational qualifications. For schools, the case bank can demonstrate the results of their training of students, especially in the cultivation of students' practical, entrepreneurial and innovative abilities. For enterprises, the application of the case bank can help deepen the integration of industry and education, and enterprises can cooperate with universities to establish teaching case banks, so as to obtain talent dividends and create greater economic value in the cooperation.

4. Discussions: Pathways to Building a Casebook for Teaching Sustainable Design Practice

This study aims to build a talent cultivation model centered on practical ability, and to design a teaching case library by considering multi-dimensional factors such as “objectives” and “case clusters”. In order to ensure the practicability and cutting-edge of the cases, we actively bring in experts from outside the university and practical tutors from enterprises to jointly promote the improvement and development of case teaching.

4.1. Constructing Competence Objectives Centered on the Cultivation of Practical Ability, and Value-Led Ideological Objectives Integrated into Curriculum Ideology

In the dimension of capacity development, this study aims to construct a thinking system for sustainable design by integrating specialized research directions, exploring the theoretical basis of green design in depth, and addressing practical issues in sustainable design (**Figure 1**). Further, specific sustainable design goals and strategies are formulated to ensure efficient resource utilization and energy conservation, providing practical solutions to sustainability issues in practice (Hou et al., 2021).



Figure 1. Lively and interesting teaching style.

From the perspective of ideological and political education, this paper systematically integrates the key points of ideological and political education, emphasizes the cultivation of environmental awareness, and encourages students to fully consider environmental and ecological factors in design. In particular, this paper emphasizes the core ideological and political elements such as “ecological civilization construction, national family and country sentiment, design ethics, and social responsibility” (David, 2014). In addition, by guiding students to combine the concept of sustainable design with practical needs and the wisdom of design culture, they will firmly use their professional knowledge to serve the country, work for the welfare of the people, and strive to improve the quality of the ecological environment.

4.2. Three Major Teaching Case Clusters, Namely “Design Literacy”, “Sustainable Design Practice”, and “Contextualized Practical Training”, Have Been Constructed to Form a Thematic Combination

Against the background of Guangdong-Hong Kong-Macao Greater Bay Area resources, this study regards it as a key area for industry-education integration. In order to comprehensively cultivate students’ practical abilities, we have innovatively proposed three major teaching case groups: “Design Literacy”, “Sustainable Design Practice” and “Contextualized Practical Training” (Xu et al., 2022). These case groups are organized in a thematic way, aiming to enhance students’ sense of responsibility and sense of duty. We emphasize the practical ability of sustainable design practice through the close connection with the industry, and strengthen the ability of contextual practical training through the cooperation with industry associations and enterprises. In summary, this study constructs a framework for designing a teaching casebook centered on practical ability (Table 1).

4.3. Jointly Involve Off-Campus Instructors and Enterprise Practice Instructors in Case Base Teaching, and Promote the Close Integration of Industry-University-Research in the Environmental Design Program

First of all, this study advocates cross-subjective curriculum development

Table 1. Teaching casebook design framework.

Case Group Name	teaching case	Detailed introduction
“Design Literacy” Case Cluster	Designer’s Responsibility and Accountability Teaching Cases	Introduces how to incorporate the concept of social responsibility in design to improve the social image and social responsibility of companies. To be ecologically and socially responsible, design must commit itself to the principle of minimizing the impact on nature, creating the least amount of design in exchange for the greatest diversity, or achieving the greatest effect with the least amount of effort.
	The Designer’s Duty and the Case for Teaching Ecological Ethics	Includes design for the Third World; design of teaching and training equipment for the mentally and physically handicapped; design of pharmaceutical, surgical, dental, and hospital equipment; design for experimental research; systematic design for sustaining human life in marginalized situations; and design for breaking stereotypes.
	The Case for Teaching Integrated Aesthetic Qualities	The case highlights aesthetic qualities, emphasizing the need for broad aesthetic knowledge and experience to create designs that move people.
“Sustainable Design Practice” Case Cluster	Designing into the Circular Economy Teaching Case	Introduces how to incorporate the concept of circular economy in design to reduce resource wastage and improve resource utilization efficiency.
	Designing into Carbon Footprint Teaching Cases	Describes how to consider the size of your carbon footprint in your design to reduce carbon emissions and minimize your impact on the environment.
	The Case for Teaching Ecological Design	Describes how to incorporate eco-design concepts in design to improve the sustainability of ecosystems.
	A Teaching Case for Green Design for Climate Suitability in the Lingnan Region	Introduces how to use traditional green wisdom, as well as green energy, in the design of regional contexts to reduce energy consumption and environmental pollution, and to master the basic strategies of local green, energy-saving, and healthy design.
	Teaching examples of sustainable design for urban and rural environments	An introduction to how to incorporate the concept of sustainability in design to improve the sustainability of cities and villages.
“Contextualized practical training” case clusters	Teaching examples of sustainable design for urban and rural environments	Large enterprises have stronger production capacity, complete facilities and advanced research means, relying on enterprises to build course cases, including communication, decision-making and summarization of situational practice, to provide students with more realistic practical training and practice scenarios.
	Examples of contextualized teaching with associations	Taking advantage of the large number of industry associations and member companies in the Bay Area, we actively recommend scenario-based practical training with the associations, including the identification and analysis of situational practices, so as to promote the organic connection between the training of students and the certification of professional qualifications.

cooperation with other higher education institutions and business instructors to realize multi-dimensional sharing of resources (Figure 2). We aim to build an integrated “online-offline-cloud” case base resource, and further explore the strategies of “multi-university cooperation” and “teacher-student collaboration” to form an open practical course system that combines professional theory and



Figure 2. Docking with enterprises and school-enterprise cooperation to jointly cultivate talents.

industry-teaching integration (Adam, 2021). Secondly, in order to enhance the practicability and depth of the courses, we have integrated practical training and seminars into the course design, inviting external experts and enterprise practice tutors to participate. Through close cooperation with enterprise projects and synergistic training in joint laboratories, we aim to improve the accuracy and practicality of casebook teaching.

The pathway and operational methods for integrating external mentors and businesses into curriculum instruction are delineated herein. Initially, by establishing strategic partnerships with industry-leading enterprises, we ensure a seamless nexus between academic research and practical applications, thereby ensuring that the curriculum remains abreast with industry trends. Subsequently, employing cutting-edge educational technology tools, such as simulation software and online learning platforms, we construct realistic work scenario simulations, facilitating students' transition between theoretical learning and practical operations. Ultimately, through periodically soliciting the participation of industry experts and corporate representatives in curriculum design and assessment, we aim to assure the practicality and foresight of the instructional content, thereby cultivating high-caliber talents that align with industry requisites.

Engaging off-campus mentors and industry practitioners in the academic curriculum offers distinct advantages: 1) They bring real-time industry knowledge and experiences, fortifying students' hands-on skills and industry application awareness; 2) This collaboration acts as a bridge, diminishing the gap between academic theory and industry practice, thereby advancing the integration of industry-academia-research and augmenting the precision and efficacy of education. However, there are challenges to be addressed: 1) The teaching content and methodologies may not always be in alignment with academic course standards, potentially leading to a deviation from educational goals; 2) There might be disparities in the objectives and interests between the corporate and academic sectors, necessitating meticulous adjustments to the collaboration model to ensure mutual benefits and alignment of educational goals.

4.4. Limitations and Advices

The limitations of this study are evident. While we employed interdisciplinary

research methodologies, there may be disparities when comparing our findings with sustainable design practices from other global regions. Additionally, our focus on the specific needs of the Greater Bay Area in Guangdong might have overlooked nuanced differences in education and design practices across various cultural contexts or regions. Furthermore, our reliance on existing case studies and data might not adequately capture emerging design trends or future industry demands. Collaborations with external academic advisors and enterprise-based practice tutors could also have introduced biases, particularly in the assessment and selection of teaching cases.

Recommendations for future research include: 1) Comparisons with sustainable design practices from other countries or regions should be considered to provide a more global perspective and understanding; 2) Engaging third-party or independent evaluation institutions during the case selection and assessment process will ensure the objectivity and fairness of the teaching cases.

5. Conclusion

This study explores the mode of cooperation between schools and enterprises and inter-schools in the teaching case base, from decentralized to centralized, from offline to online, and from purely theoretical to practical projects, so as to construct a multi-dimensional cooperation framework. By categorizing the case clusters in the three core dimensions of “design literacy”, “sustainable design practice” and “contextual training”, this study covers sustainable design practice cases in a variety of fields and industries. This study involves sustainable design practice cases from a wide range of fields and industries. Considering the actual needs of student training in the Greater Bay Area of Guangdong, Hong Kong and Macao and the characteristics of regional economic development, this paper proposes a comprehensive solution to enhance the applicability and relevance of the teaching case base to ensure that it can meet the talent training needs of the Greater Bay Area. In addition, this study aims to promote innovative cooperation among inter-schools, school-enterprises and school associations, and to provide useful references for educational practices in Guangdong Province and the whole country.

Regarding the operability of industry-academia-research integration in the environmental design sector: Firstly, grounded on the application of systems theory and intertwined with interdisciplinary research techniques from design science and other disciplines, the construction of the teaching case bank solidifies students’ understanding of interdisciplinary research methodologies in sustainable design. Secondly, by opting for a plethora of sustainable design practice teaching cases, students are poised to grasp the inherent principles and logic of sustainable design, ensuring better alignment with the local design industry. Moreover, through exploring collaboration mechanisms between academic institutions and enterprises, and among academic institutions, we move from a fragmented approach to a consolidated one, from offline to online modalities,

and from purely theoretical frameworks to pragmatic projects, thereby sculpting a multi-dimensional cooperative paradigm. Furthermore, given the actual training requisites of students in the Guangdong, Hong Kong, and Macao Greater Bay Area and the unique regional economic development characteristics, a holistic solution has been propounded to amplify the pertinence and congruence of the teaching case bank, ensuring it resonates with the talent development aspirations of the Greater Bay Area.

In subsequent research, our team will primarily focus on the practical application and benefits of the teaching case library in the Guangdong Greater Bay Area. Currently, as the integration between industry and education intensifies, coupled with the global trend towards sustainable design practices, understanding how to effectively merge these two domains to cater to regional-specific demands warrants thorough investigation.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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