



Knowledge Product Service System Design for Sustainability Education

Scenarios for Sustainability Design Consciousness Course at Tongji University

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A thesis by
TANG Runyu 10617669
Supervisor: **Davide Fassi**
Co-Supervisor: **ZHU Xiaocun**

Abstract

Design as the basis of human activities has responsibility for current environmental crisis, but at the same time has great potential to solve these problems. Design students as future designers should have the knowledge and mindset of designing for sustainability. The “Sustainability Design Consciousness” course offered by the College of Design and Innovation of Tongji University has established a preliminary teaching service model after years of development. Therefore, this study mainly uses the service design method and knowledge building theory, explores how to optimize the existing knowledge product service system to enhance the learner's learning experience and promote the collaborative construction of knowledge in the learning community.

Firstly theoretical research is conducted from two perspectives: from the perspective of knowledge content, it is clear that the holistic perception and ecological awareness are the two key points of sustainable consciousness; from the perspective of service form, it is clear that the mutual cooperation between students is helpful. In order to create and improve existing system, the establishment of a shared knowledge library is conducive to promoting collaborative learning.

On this basis, using the concept and tools of service design and the user research methods of observation, questionnaire and interview, combined with the analytical principles or framework derived from theoretical research, the research on the “Sustainability Design Consciousness” course is developed from the four aspects: knowledge ability and transformation mechanism, stakeholder and service ecosystem, user journey based on knowledge life cycle, service touchpoint and user experience. The status quo of knowledge product service system is evaluated, with users’ pain points and needs being defined, and thus various design opportunities for improving the original service system are analyzed.

Finally, the design opportunities are categorized according to the levels of service innovation and design solutions are proposed respectively. The design of the open knowledge library, as the main design output, together with the self-teaching/learning class, toolkit for assignment, and open forum/exhibition for research projects compose a learner-centered, open, and sustainable knowledge product service system.

However, research and design for one single course is just the starting point of the changing paradigm of design for a sustainable future. Building a holistic and sustainable design knowledge service ecosystem is the future direction of efforts.

Key Words

Service Design, Knowledge Product Service System, Design for Sustainability, Teaching of Design, Knowledge Building

Astratto

Il design come base delle attività umane ha la responsabilità dell'attuale crisi ambientale, ma allo stesso tempo ha un grande potenziale per risolvere questi problemi. Gli studenti di design come futuri designer dovrebbero avere le conoscenze e la mentalità di progettare per la sostenibilità. Il corso "Consapevolezza del design di sostenibilità" offerto dal College of Design and Innovation dell'Università di Tongji ha stabilito un modello di servizio di insegnamento preliminare dopo anni di sviluppo. Pertanto, questo studio utilizza principalmente il metodo di progettazione del servizio e la teoria della costruzione della conoscenza, esplora come ottimizzare il sistema di servizio del prodotto della conoscenza esistente per migliorare l'esperienza di apprendimento dello studente e promuovere la costruzione collaborativa della conoscenza nella comunità di apprendimento.

In primo luogo la ricerca teorica è condotta da due punti di vista: dal punto di vista del contenuto della conoscenza, è chiaro che la percezione olistica e la consapevolezza ecologica sono i due punti chiave della coscienza sostenibile; dal punto di vista del modulo di servizio, è chiaro che la cooperazione reciproca tra studenti è utile. Al fine di creare e migliorare il sistema esistente, l'istituzione di una biblioteca di conoscenza condivisa favorisce l'apprendimento collaborativo.

Su questa base, utilizzando il concetto e gli strumenti di progettazione del servizio e i metodi di ricerca dell'utente di osservazione, questionario e intervista, combinati con i principi analitici o la struttura derivata dalla ricerca teorica, la ricerca sul corso "Consapevolezza del design di sostenibilità" è sviluppata dal quattro aspetti: capacità di conoscenza e meccanismo di trasformazione, stakeholder e ecosistema di servizi, percorso dell'utente basato sul ciclo di vita della conoscenza, punto di contatto del servizio ed esperienza dell'utente. Viene valutato lo status quo del sistema di servizio del prodotto della conoscenza, con la definizione dei punti deboli e delle esigenze degli utenti, e quindi

vengono analizzate varie opportunità di progettazione per migliorare il sistema di servizio originale.

Infine, le opportunità di design sono classificate in base ai livelli di innovazione del servizio e vengono proposte rispettivamente soluzioni di design. La progettazione della biblioteca di conoscenza aperta, come output principale del progetto, insieme alla classe di auto-insegnamento / apprendimento, toolkit per assegnazione e forum / mostra aperti per progetti di ricerca compongono un sistema di servizio di prodotto di conoscenza centrato sullo studente, aperto e sostenibile.

Tuttavia, la ricerca e il design per un singolo corso sono solo il punto di partenza del paradigma mutevole del design per un futuro sostenibile. Costruire un ecosistema di servizi di conoscenza di progettazione olistica e sostenibile è la direzione futura degli sforzi.

Parole chiave

Service Design, Sistema di servizio del prodotto della conoscenza, Design per la sostenibilità, Insegnamento del design, Sviluppo della conoscenza

Acknowledgements

My research is just a drop of water in the unstoppable torrent of design change towards sustainability. But this drip made me realize the inescapable responsibility that I have as a designer. It was a fortune for me to learn in this school that is open and inclusive for the future, and meet mentors who focus on continuous innovation in sustainable education. Given the opportunity to participate in the teaching practice of sustainable design, research and design with what I learnt in service design, and then put into practice, I wish this study would bring a little inspiration to future designers.

In acknowledge I would like to thank all the teachers who have taught me the knowledge and experience, especially my supervisors Davide Fassi and Zhu Xiaocun. It was their consistent effort and encouragement that allows me to see my own characteristics inward, to see the breadth and depth of design outwards, and at the same time to learn serious and rigorous design habits and research spirit.

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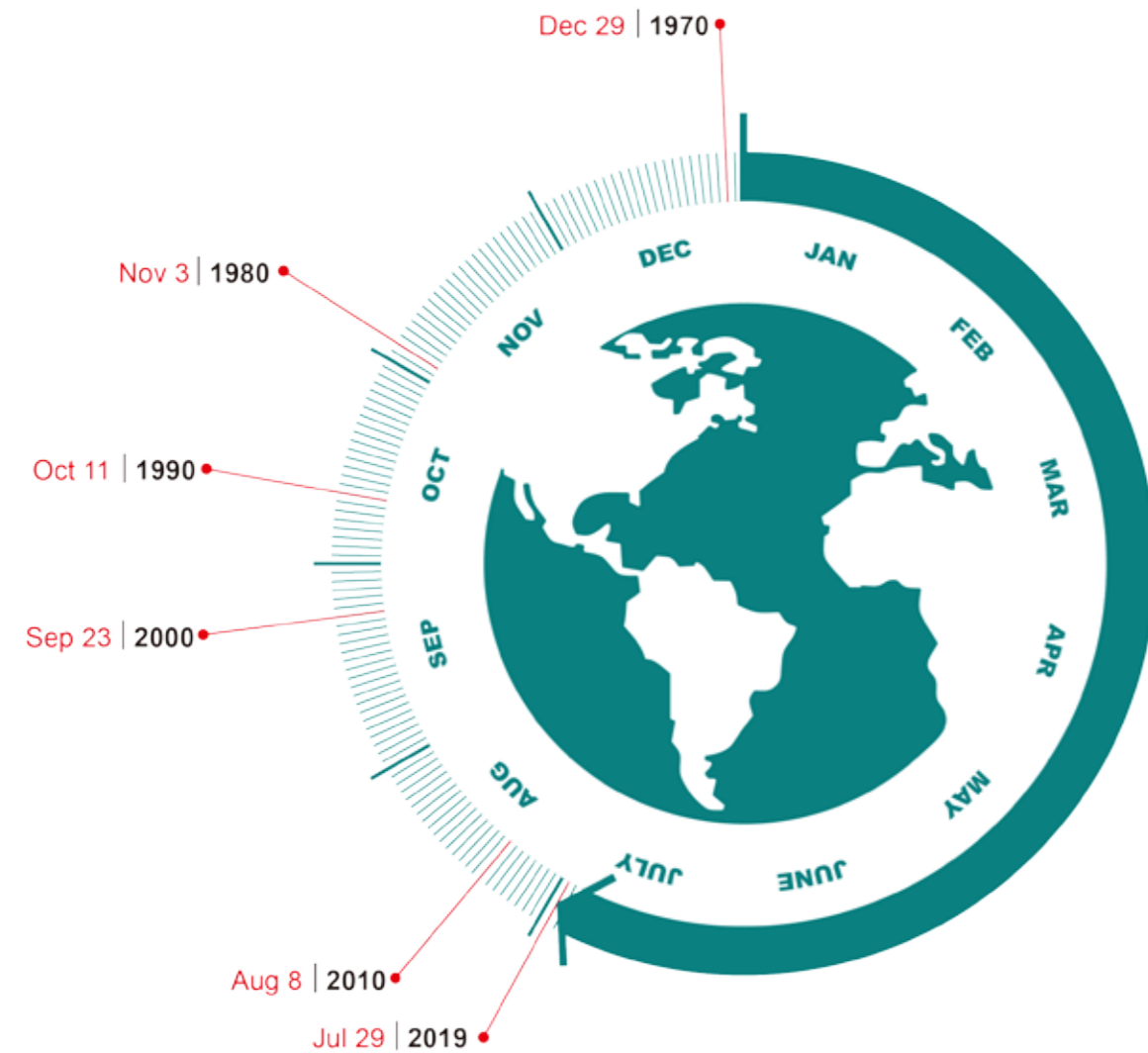
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Research Background: Global Ecological Challenge

The Earth Overshoot Day of Year 2019 was July 29, which meant humans used up the renewable natural resources, that earth was able to regenerate in a year, in less than 8 months.



Source: Global Footprint Network National Footprint Accounts 2018

Research Background: Global Ecological Challenge

Global sustainability issues are becoming more and more serious, and the impact of human activities on the environment is increasing exponentially. Behind the development of human society and the seemingly benign solutions, new challenges are still emerging. In the recently published "Come On", the Club of Rome pointed out that the state of human beings is different from the past, from the "empty world" with abundant resources to the "crowded world", which is now full of people (Wei Bole, Vijay Man, 2018). We have entered the "Anthropocene" (Crutzen & Stoermer, 2000). Every year, the Global Footprint Network calculates the rate at which humans consume the Earth's natural resources by comparing the total annual human consumption (ecological footprint) with the Earth's ability to regenerate natural resources (ecological capacity). The date when human activities exhausted the natural resources of the year was called the Earth Overshoot Day. As shown in Figure 1.1, this date continues to advance. In 1970 it appeared in late December, and last year, July 29, 2019, was "the earliest Overshoot day since the early 1970s" (Global Footprint Network, 2019).

The sustainability problems we face are becoming more and more urgent, but the society's response to this is far from enough. Our lives are filled with endless items that we buy, use, discard, waste or save every day, but each of them has its own past and future, with stories and final destinations behind the production process. And these links are all we can't see, and we don't know the series of effects in the entire product life cycle, so we can't make a more environmentally friendly choice (Golman, 2018). There is a clear difference between our perceptions and everyday behaviors and the sustainability issues we face. Therefore, improving sustainability consciousness can enable people to have a more accurate and in-depth understanding of these issues, promote the transformation of behavior, and then arrive to the solution of problems. However, the improvement of sustainability

consciousness requires people to obtain through conscious learning, so this requires the joint efforts of all sectors of society. Among many solutions, education has become an important way to raise sustainable awareness (Zhu & Leuba Dit Galland, 2018).

i Every year, the Global Footprint Network computes how fast we exhaust Earth's natural resources "by comparing **humanity's total yearly consumption** (ecological footprint) with **Earth's capacity to regenerate renewable natural resources** in that year (bio capacity).

"In many ways, the environmental crisis is a design crisis. It is a consequence of how things are made, buildings are constructed, and landscapes are used."

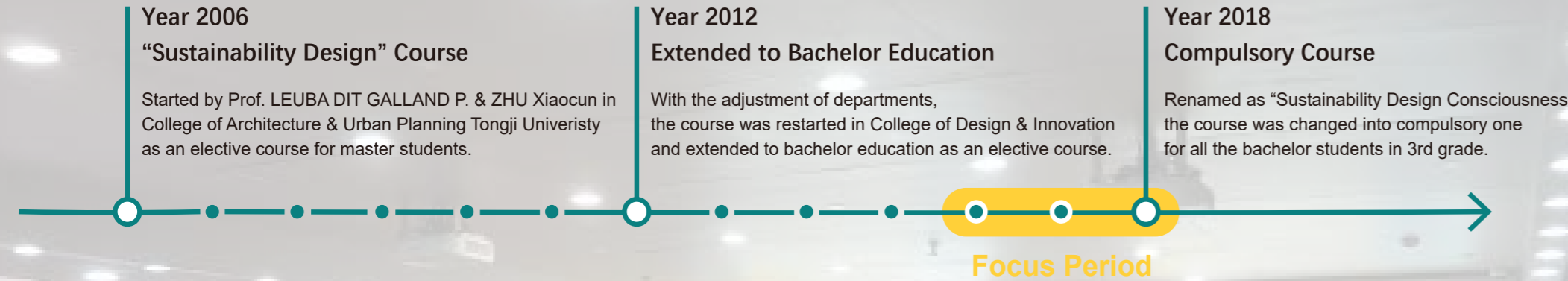
Design, as the basis of all human activities, has become the most powerful tool for humans to shape objects and the environment (and the society and selves derived from it) (Papanek, 1991). As the inhabitants of the earth and planners of the future, designers should be the first to have a sense of sustainability. For the benefit of mankind, sustainability should be a part of design education and the design industry that cannot be ignored, because design behaviors and results are closely related to human material and resources, water, energy, climate change, food production, natural systems, and so on. It has a broad and far-reaching impact. In the "empty world" period, people believed that resources are inexhaustible. Design was used as a tool to promote consumption, meet user needs and obtain benefits. The consideration of environmental impact is often simple and blind. The life cycle of products were often considered to be one-way linear. This resulted in a design pattern that only considers human comfort in a short time and a small range, but ignores the long-term and large-scale impact. It makes us unconsciously destroy the biosphere environment on which human well-being depend, endangering the present and future human survive. Therefore, in the "crowded world", the limited earth resources urge design and design education to make corresponding changes from the fundamental consciousness and strategic methods, and to place sustainability at the core, with a long-term perspective and overall consciousness, to consider the development of humans and the environment as a whole.

Based on this big goal, designers need to have the corresponding knowledge and ability to understand the sustainable issues involved in design and consciously design for environmental sustainability. Design education is the knowledge environment that young designers are exposed to before entering the design industry (before they really begin to have the ability to have a positive or negative impact on the environment through design). During this period, the education received

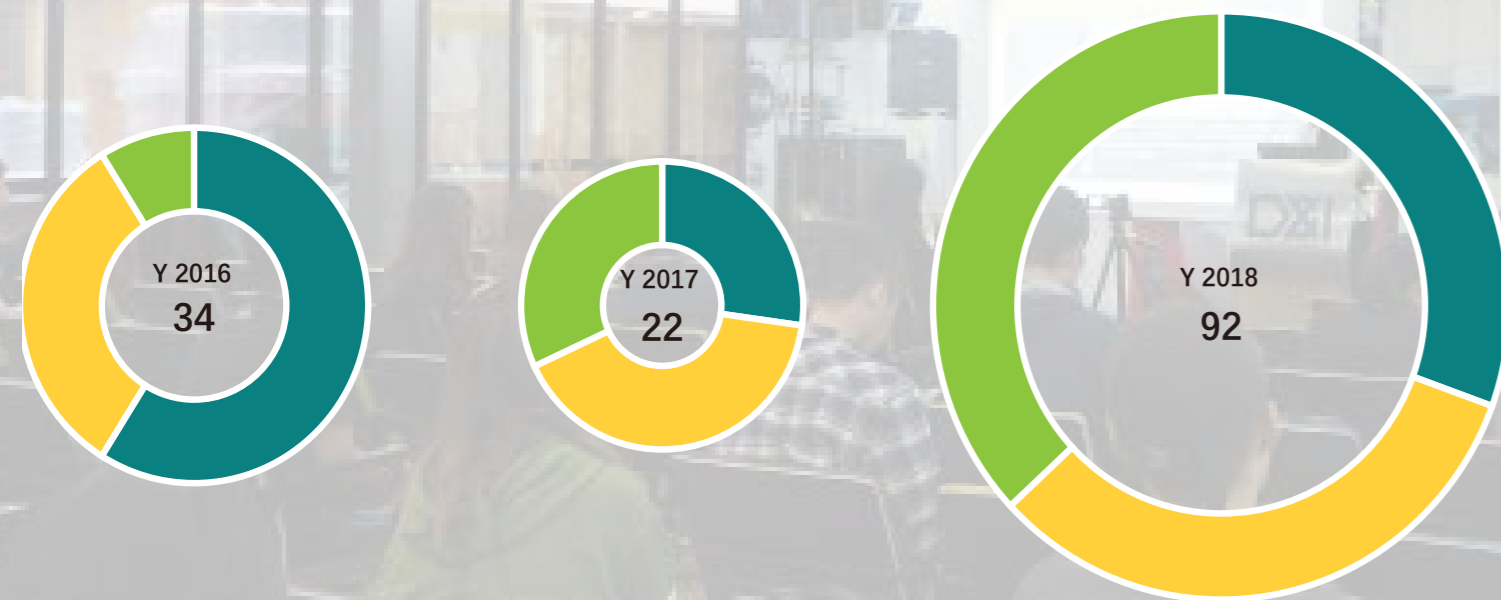
by design students and their understanding of sustainable issues will influence the design concepts and strategic approaches they use later in their design careers. Therefore, many design colleges and universities have integrated sustainable teaching into design courses.

Research Background: Sustainability Design Consciousness Course

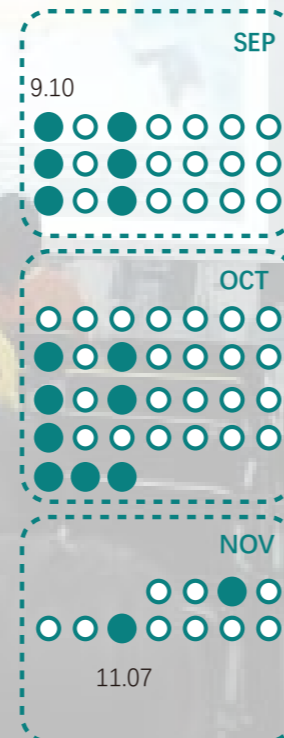
Course Development History



Students Number and Distribution



Schedule



Research Background: Sustainability Design Consciousness Course

In the spring of 2006, the School of Architecture and Urban Planning of Tongji University started the "Sustainable Design" course as a cutting-edge design course elective for graduate education, promoted by Professors Leuba Dit Galland and Xiaocun Zhu. After 2012, it was further expanded to undergraduate teaching and opened to all majors in the School of Design and Innovation. Beginning in 2018, the course officially changed its name to "Sustainability Design Consciousness" and became a compulsory course for all third-year undergraduates. The course aims to provide students with an understanding of the reality, urgency, and seriousness of the sustainable issues we face today. It also provides students with theoretical knowledge on how to create sustainable designs. With over ten years of teaching practice exploration, this course has accumulated rich teaching experience, but at the same time there are certain problems and space for improvement. The course is currently in the development stage, and the course content and teaching format are gradually adjusted and updated. The author mainly participated in the teaching activities of the 2016 and 2018 fall semesters as a role of teaching assistant. This thesis will take the "Sustainability Design Consciousness" course as an example to analyze and research on the current situation of course teaching, and tap the potential opportunities for further development.



The application of service design in teaching scene can bring a new perspective to the research and design of teaching activities. Combining with the core principle of service design thinking (Stickdorn & Schneider, 2011), the characteristics of research and design of teaching activities in the field of sustainable design introduced into service design can be summarized as follows:

User-centered: experience and understand the various aspects of knowledge services from the learner's perspective. The goal is to raise the sustainability awareness of design students.

Co-creation: coordinate and organize all stakeholders to participate in the design and implementation of knowledge services, and improve the efficiency of the service system through innovative interaction among stakeholders;

Holistic: the process of knowledge service is connected by a series of interrelated teaching activities, and all activities and their connections should be fully considered.

Visibility: invisible knowledge services will be presented as physical objects or visible knowledge products. Or from the perspective of knowledge construction, the knowledge is given a certain form to make it visible, usable and transmissible;

Integrity: considering the overall situation of knowledge service, make full use of the resources in the environment;

Sustainability: connect tangible knowledge products and intangible knowledge services, and transform the independent production cycle of knowledge into an integrated production and consumption cycle from the perspective of the system, so as to improve the stability and continuous operation of the system.

Research Background: Service Design Brings a New Perspective to Teaching Research and Practice

Service design is a creative, user-centered approach to determine the content and way of service delivery according to the needs of users to meet or improve the user experience. Service design provides valuable mobility to specific users by setting and building a series of processes. The final form of service design can be tangible or intangible, and it may involve other elements such as product or expression, environment, and behavior (Hollins & Shinkins, 2006).

Service design and its related theories point out new directions for other research in different fields. The research of service design has gradually shifted from the macroscopic theoretical research and the exploration of design methods to the integration with other more fields. In the research and practice of teaching activities, service design has also attracted some attention. Because in essence, teaching is also a service related to knowledge. It conforms to some commonalities of service (Qin Junchang, Zhang Jinliang, Wang Kanliang, 2010) :

Service is an activity, through a series of management means such as planning, implementation and control, service providers provide users with service products that meet their needs. Teaching is an activity in which teachers provide students with knowledge and ability through a series of teaching methods such as curriculum design, teaching and tutoring.

The invisibility of service means that service products not only include tangible goods, but also intangible services. And services are perishable; they cannot be stored in the same way as manufactured goods. Teaching activities are also intangible, in which there may be textbooks, mock-ups and other tangible things, but a lot of communication between teachers and students is intangible. Teaching activities are real-time and cannot be copied or stored.

Production and service are carried out simultaneously, which puts

forward higher requirements for demand and service capacity matching, sales and production integration planning. In teaching activities, students' flexible demand for knowledge requires teachers to mobilize personal knowledge reserve or other teaching resources to meet, and the production and service of knowledge are carried out simultaneously.

Therefore, we can try to introduce the concept and thinking of service design into the teaching field. Specifically, students, as the main service recipients, are the target users of the service design. Teachers and teaching administrators are the main service providers and are often the designers of teaching services. The purpose of teaching service is to explore the potential needs of students, so as to improve the teaching experience and quality. The service takes place mainly in the classroom, but there are also extracurricular and even online teaching activities. Teaching services realize the value of service through teaching, coaching, workshops and other actions. Text, pictures, video and audio teaching resources such as textbooks, blackboard writing, slides are the common service media.

Therefore, in the research and design of teaching activities, relevant theories and tools of service design can be used to carry out systematic research and analysis on teaching activities from the perspective of learners. In the design and practice of teaching activities, theories related to learning, such as service design and knowledge construction, can be organically combined to improve the learning experience of learners and the efficiency of teaching conversion in the teaching process, so as to achieve better teaching results.

Literature Review: Mapping

Teaching of Design for Sustainability

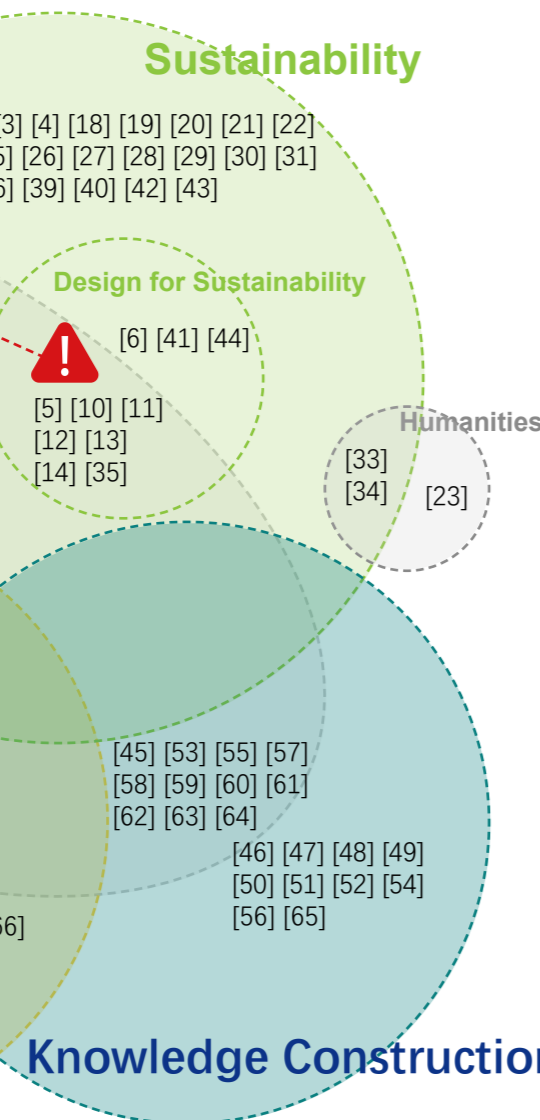
mainly from the perspective of educators

Teaching/Education

Service Design for Teaching Scenarios

started from design subject, has not cover content about sustainability

Service Design



Reference Source from: Research Gate, Academia, CNKI

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Literature Review: Teaching of Sustainable Design

In the past 30 years, "sustainable design" has become an important issue in the forefront of design, and design education has also undergone important changes. Many design schools are gradually offering courses or programs related to sustainable design. Scholars at home and abroad have studied how to carry out the teaching of sustainable design from different angles. Deniz (2016) pointed out from the changes in the roles and responsibilities of designers that design should be taught in a social ecological context so that design students could understand the environmental impact of design decisions and measures. Tischner (2016) sorted out the strategies, methods and tools related to sustainable design and proposed to set up more teaching programs to provide more practical sustainable design skills training for design students. Zhang ruifeng et al. (2013) explored the cultivation of sustainable design concept from three aspects of schools, students and teachers, and proposed to establish a comprehensive and complete education system of sustainable art design. Lv Mingyue (2015) from the different characteristics of sustainable design curriculum and teaching methods in various design colleges and universities in China, advocated the synchronous sharing of contents and achievements of sustainable design curriculum in different places. Marttila and Kohtala (2014) advocated the establishment of an interdisciplinary learning platform to teach sustainable knowledge to design students from the perspective of interdisciplinary research and education.

International collaboration around sustainable design is also under way. Recently, China's design schools have developed two local cooperative networks supported by the international design research network. One of them is The LeNS China project developed by LeNS (The Learning Network on Sustainability) in 2009, which aims to establish an open online resource for teaching sustainable design to promote cross-disciplinary cooperation in sustainable design. Currently, a number of

design schools have participated in this project. The other is the DESIS-China project developed in China by professor Ezio Manzini (Design for Social Innovation and Sustainability). Six major design schools in China are involved and have established independent but interconnected DESIS LABS, which combine local resources and conditions to carry out design and research related to social innovation and sustainability. At the same time, it collaborates with other laboratories around the world and actively participates in large-scale design projects and research plans.

However, most of these researches and practices are from the perspective of education managers or teachers, and put forward the methods of sustainable design teaching at a macro level. There is a lack of systematic research from the micro perspective of classroom teaching, which ignores the real learning experience of students in the teaching activities of sustainable design. This paper will focus on a specific sustainable design course, use the methods and tools of service design to carry out a systematic analysis of the current situation of the course, understand the experience and needs of learners through user research, and propose a learner-centered service innovation design for teaching and learning from the perspective of service design.

Literature Review: Application of Service Design in Teaching Scenarios

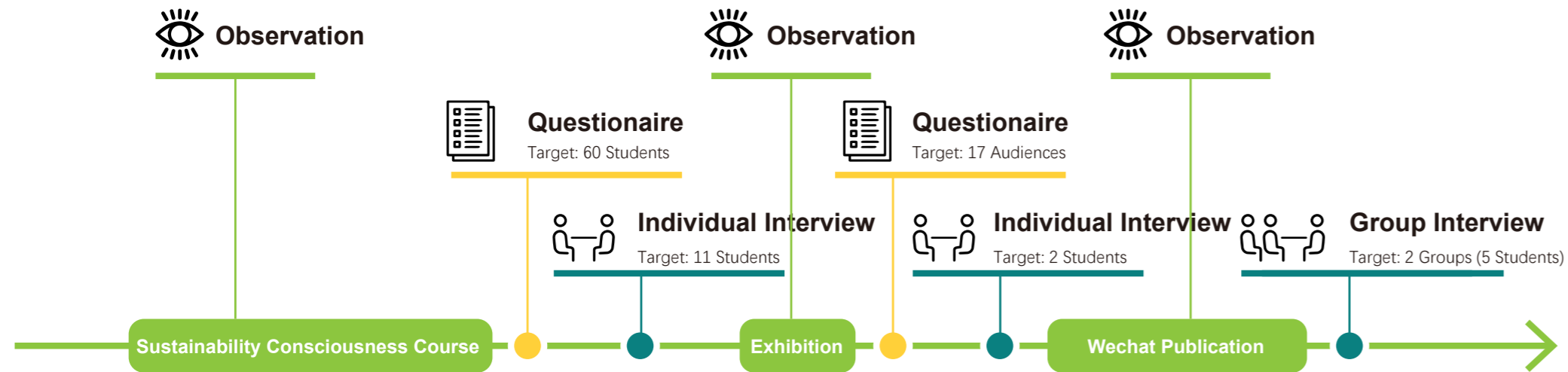
The application of service design in the teaching scene, emphasizing the learner as the center, the interaction and cooperation among the participants in the teaching activities, and the emphasis on the integrity and relevance of teaching activities as well as the sustainable development of knowledge can bring a new perspective to the research and design of teaching activities. In recent years, researchers in the field of design and education in many colleges and universities have carried out relevant research and practice. For example, Liu Yu and Cang Shijian (2014) of Tianjin university of science and technology applied the concept of service design to improve the teaching mode of toy design major. Starting from focusing on user experience to create more effective services, they designed a student-centered curriculum framework and a teaching activity plan before, during and after class. He Siqian (2016) from Beijing technology and business university analyzed and reflected on the existing teaching problems in the course of introduction to design based on the service design thinking method, carried out service design for the whole process of teaching activities, and reshaped the learning experience by using the tools such as user journey map and participatory design commonly used in service design in teaching practice. Shanghai Institute of Visual art Fan Xijia and Huang Weida (2016) the use of service design concept of teaching breadth and cross major to create design teaching platform to think, to cross major public course teaching research group and special service elements system, service relationship and interaction analysis and discussion of the service delivery process.

It can be seen that the application of service design in teaching activity research starts from the course teaching of design major, but there is no service design research on courses related to sustainable design. Therefore, this paper tries to explore the intersection of service design and sustainable design teaching, which is an expansion of service

design theory and tool application scenarios, and also a new perspective of service design for sustainable design teaching research.



Research Methods



Research Methods

User Research Method

In order to study and evaluate the course of "Sustainability Design Consciousness" in the school of design and creativity of Tongji University, we need to understand the current situation of knowledge product service system, including the potential and problems of the system, as well as the experience and needs of users. An insight into the pedagogical behavior and learning experience of educators and learners needs to be established, with emphasis on understanding specific situations and needs. The main data collection methods are:

Questionnaire survey: the author will conduct a status survey through two questionnaires. One of them was used to investigate the learning and experience of students participating in the course of "Sustainability Design Consciousness". Another paper was used to investigate the needs and knowledge sharing and utilization of design students from other schools who visited the exhibition of course results. Questionnaires were distributed and collected through online tools.

Interviews: the author conducted several interviews with participants of the course, including teachers from the course teaching team, students who participated in the 2018 course, students from other schools who participated in the course achievement exhibition, and course assistants. Through these interviews, we can understand the original intention and basic structure of the curriculum knowledge product service system of teachers, students' subjective experience of corresponding teaching activities, as well as students' feedback on the implemented improvement measures.

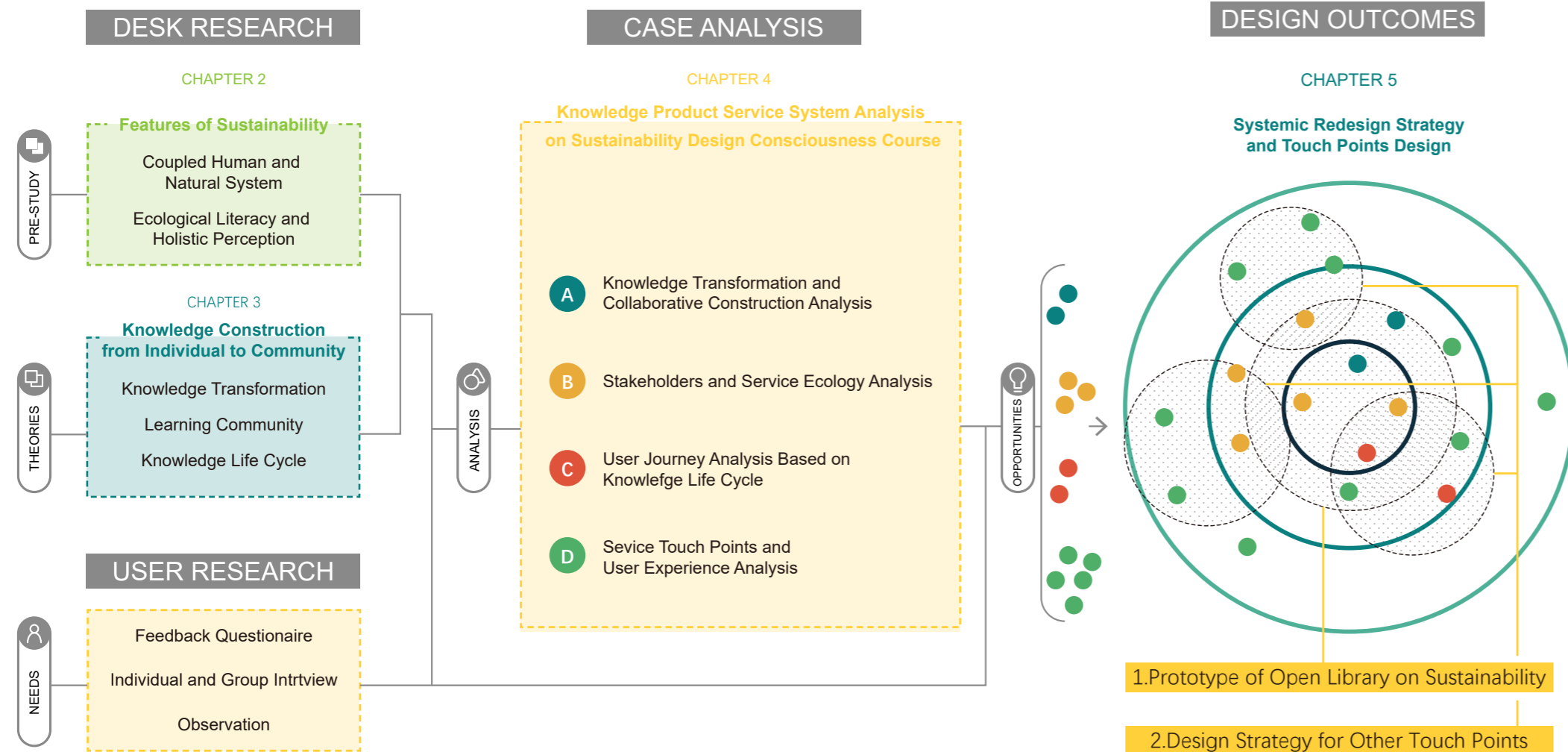
Observation: during the research period of the thesis, the author participated in the student teaching assistant work of the Sustainability Design Consciousness course, including two courses from September to December 2016 and September to December 2018. In addition, the

author also participated in the student report session of the second-year environmental art major "principles of architecture" course in School of Fine Arts, Shanghai University in March 2018, which is related to the utilization of course knowledge products. These on-site observation and direct participation can help the author to have a deep and comprehensive understanding of the knowledge product service system and accumulate some insights.

Tools and Methods of Service Design

The author will systematically analyze the teaching activities of "Sustainability Design Consciousness" course with the thinking and tools of service design. It mainly includes studying and combing the relationship between stakeholders and each other established by knowledge flow in teaching activities by using Stakeholder Map and Service Ecology Map. The User Journey Map based on the theory of knowledge life cycle was used to analyze the different stages of knowledge life cycle, the behavioral activities of service participants and the knowledge flow in teaching activities. Combined with the theory of knowledge construction, this paper explores the user experience and the effect of knowledge construction brought by the knowledge products and services of different contents and forms provided in the teaching activities. On the basis of in-depth research, the concept of service design is applied to carry out the design of teaching activities and related tools are used to express.

Research Framework

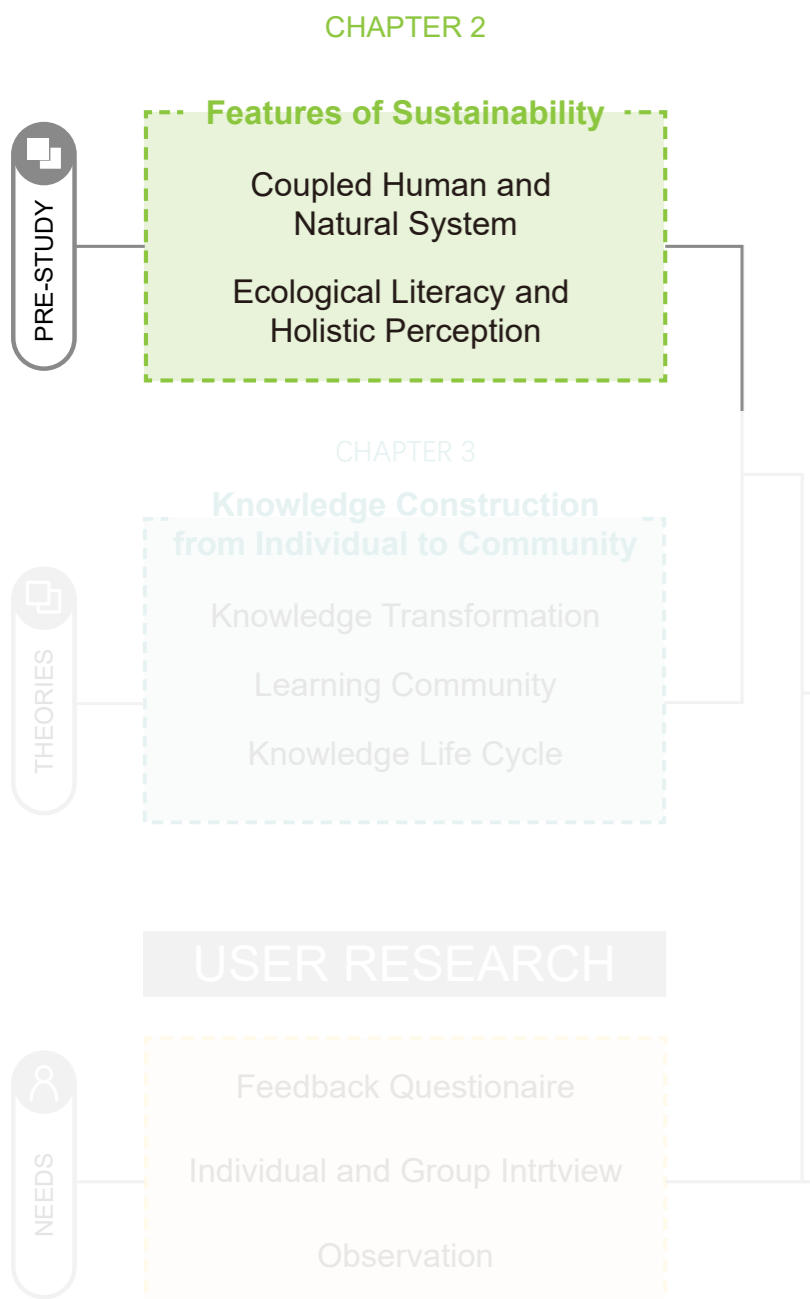


Research Framework

First, this study applies the method of literature research on design students' sustainable knowledge product service system: from the perspective of knowledge content, it is clear about the Holistic Perception and Ecological Literacy is the two key points of sustainable awareness, and points out that the thinking mode of the concept of sustainable teaching system is more important than the specific technical methods; From the perspective of service form, through the study of the theory of knowledge construction, the paper analyzes the process of knowledge construction from individual to community, and concludes that the mutual cooperation between students is conducive to the acquisition and optimization of their own knowledge.

On this basis, by using the concepts and tools of service design and the user research methods of observation, questionnaire and interview, and combining with the analytical principles or framework obtained from theoretical research, this paper conducts a deep study on the course of "Sustainability Design Consciousness" in the recent three years. From knowledge transformation and collaborative construction, stakeholders and service ecology, user journey based on knowledge life cycle and service touch points and user experience, the evaluation of the current situation of knowledge product service system, excavated user pain points and requirements, the induction is used to improve the existing service system of various design opportunities.

Finally, the user needs and design opportunities obtained from the case analysis are sorted out by using the level of service innovation, and the expression form of the open knowledge base and the design scheme of the usage scenarios are proposed respectively, as well as the design improvement strategies of other service touch points, including the independent learning class, classroom exercises and the open exhibition of research projects.



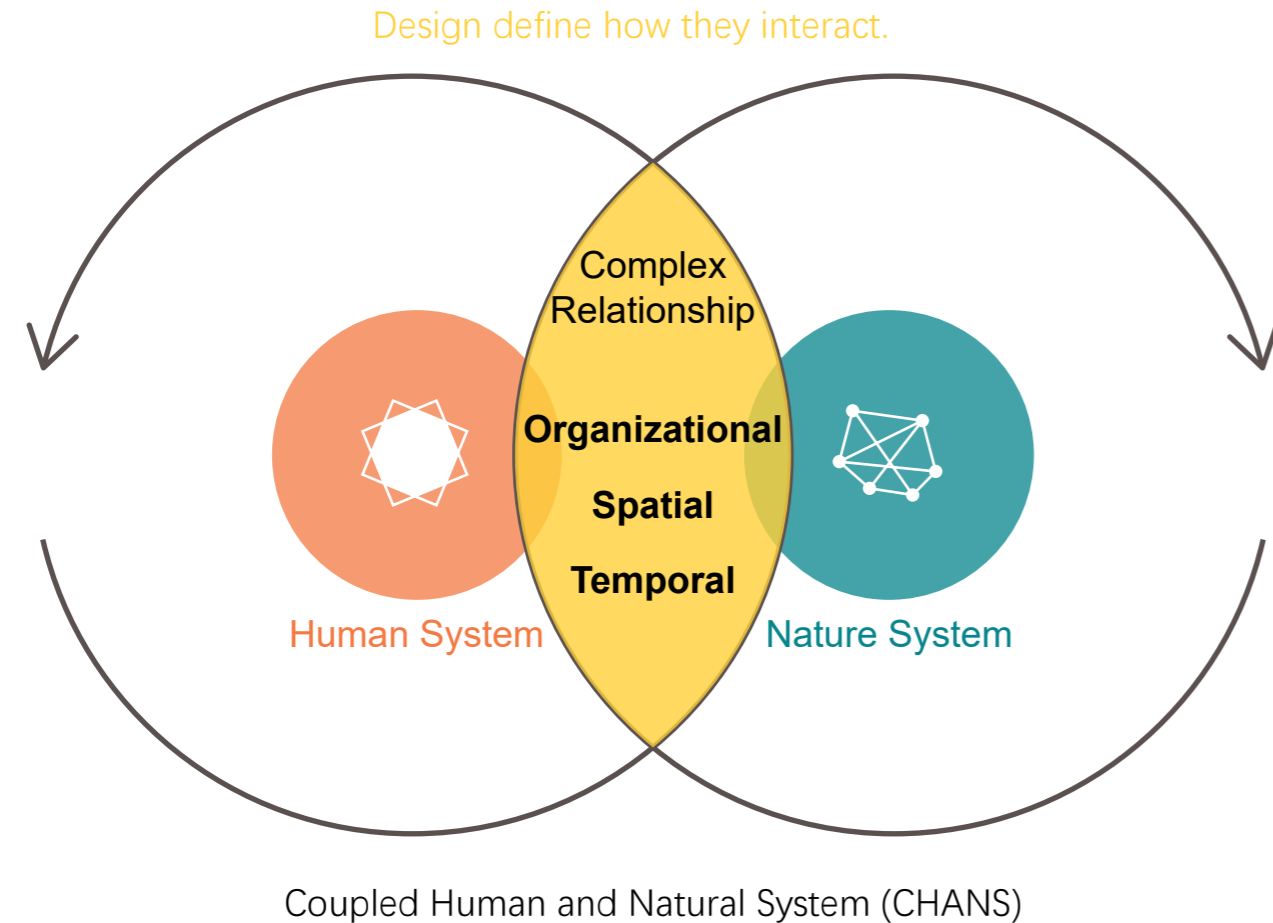
1.Pre-Study

What knowledge and ability students need to learn from the course?

Chapter Intro

This chapter is divided into three parts: the first part clarifies the important status of environmental sustainability from the connotation of sustainable concept; the second part draws the necessity of establishing sustainable consciousness from the complex characteristics of human-nature coupling system and the limitations of human cognition. The third part is the establishment of two key capabilities of sustainable awareness and the main teaching content of sustainable design concepts. The main purpose is to sort out and summarize the knowledge content that design students need to master through the "Sustainable Design Consciousness" course to help later research and analysis of the course content and knowledge structure and the design of knowledge product service system.

Through long interactions between human and natural systems, a coupling system between humans and nature is formed, with organizational, spatial and temporal complexity.



The system is a whole set of interconnected elements that can achieve a certain goal (Meadows, 2012).The earth is a large human-nature coupling system composed of many smaller coupling systems, which are interconnected through the flow of information, matter and energy and evolve over time into a set of interconnected complex adaptive systems (Liu J, et al., 2015).Through the interaction between human system and natural system, the coupling system of human and nature is formed, and presents the complexity of organization, space and time.

Organizational Coupling

A system can be the sum of multiple subsystems, and it can also be a subsystem of a larger system as part of a larger system (Meadows, 2012).The human-nature coupling system is an entity concept with nested hierarchy (Gunderson & Holling, 2001;Allen & Starr, 1982). Its complex organizational coupling is reflected in the interaction and feedback between humans and nature at different organizational levels.

Humans rely on nature for a wide range of ecological services, including clean water, clean air, healthy soil, fossil fuels, food, shelter and medicines. Human activities will affect or even threaten the dynamic balance and operation mode of the earth's ecological services. For example, only a quarter of the earth's land is largely untouched by human activities, and wetlands are the most affected, having lost 87% in recent times (intergovernmental platform for scientific policy on biodiversity and ecosystem services, 2018).Between 2000 and 2010, large-scale commercial agriculture accounted for about 40% of forest conversion, and local subsistence agriculture for about 33%.The remaining 27% of forest degradation is caused by urban expansion, infrastructure expansion and mining (Hosonuma, et al., 2012).Human activity has significantly altered the land cover, the water cycle, and even

the earth's climate system.The effects of human activity today are so widespread and profound that they dramatically alter the lives of other species on earth. According to WWF's latest living planet report 2018, the number of fish, birds, mammals, amphibians and reptiles around the world fell by 60% between 1970 and 2014, compared with the same period in 1970.In other words, the populations of these species continued to decline, on average more than half in less than 50 years.

Nature affects human systems through environmental degradation and disasters. Significant environmental degradation, such as desertification and sea level rise, is forcing people to leave their original habitats and become "environmental refugees".It is estimated that by 2050, the number of environmental refugees will reach 150 million (gao lijuan, huo wenmian, dou libao, 2008).However, natural disasters affect the survival and life of human beings by destroying infrastructure, causing casualties, spreading diseases, economic losses and social conflicts. The most recent example is in early 2019, when the polar vortex caused extreme cold in many parts of the United States, with temperatures in some states as low as minus 52 degrees Celsius. At least 22 people died in the cold.In July 2018, heavy rains hit Wudu district, Longnan city, Gansu province, causing floods and floods. Many roads, farmland and houses were washed away. A total of 126,220 people were affected and the direct economic loss was 715.172 million RMB.(chinanews.com, 2018).

The mode and process of human activities' influence on nature and the feedback of nature's influence on human are the symbols of human-nature coupling system. In different situations, these influences and feedback can have negative or positive effects, and can cause the change rate of human interaction with nature to slow down or accelerate. For example, since the beginning of the industrial revolution, the emission of greenhouse gases is closely related to the rate of change of human

activities, and the rapidly increasing rate of change of human activities leads to the exponential increase of greenhouse gas emissions. On the other hand, the effects on humans, such as the greenhouse effect, have also increased significantly.

As a result of the interaction and influence between human beings and nature sometimes occurs indirectly. For example, through the manufacture and use of industrial products, processed and synthetic foods, we are unaware of our dependence on natural systems. Changes in ecosystems and support services as a result of human activity can also be indirect, such as impacts on a wide range of land and water environments that ultimately affect habitat and species richness and abundance. Natural systems usually require multiple loop feedback on human activity can be reflected, such as DDT will all along the food chain link transfer, diffusion and aggregation, from grass to the cow, made from milk butter, cheese and other dairy products, after being human consumption, toxin may even between mother-to-child transmission (Carson, 2014).

Spatial Coupling

The multiple nesting relationship between human and natural coupling system also includes spatial scale. The local coupling is affected by the process of larger spatial scale, and the coupling of larger scale will be interfered by the process of larger scale. Finally, they are correlated and interact with each other in the space of global scale. The accumulation of local process interactions has gradually strengthened the coupling at global and regional scales. Such as greenhouse gas emissions, deforestation, heavy metal pollutants flowing into rivers and oceans. The scale and speed of human activity are expanding, populations, goods and services are moving around the globe, and new ecological and

socio-economic systems are coevolving at regional and global scales. In the context of globalization, species, harmful substances and microorganisms have also migrated along with human activities and natural cycles, and coupling in one area can be transferred to other areas. For example, pollution from factories upstream of the water affects the safety of drinking water downstream. Climate change, such as the greenhouse effect caused by emissions from rich countries, increases disease and death in poor areas. The interaction between human beings and the natural environment spans different spatial locations and scales and is universal in the world.

Time Coupling

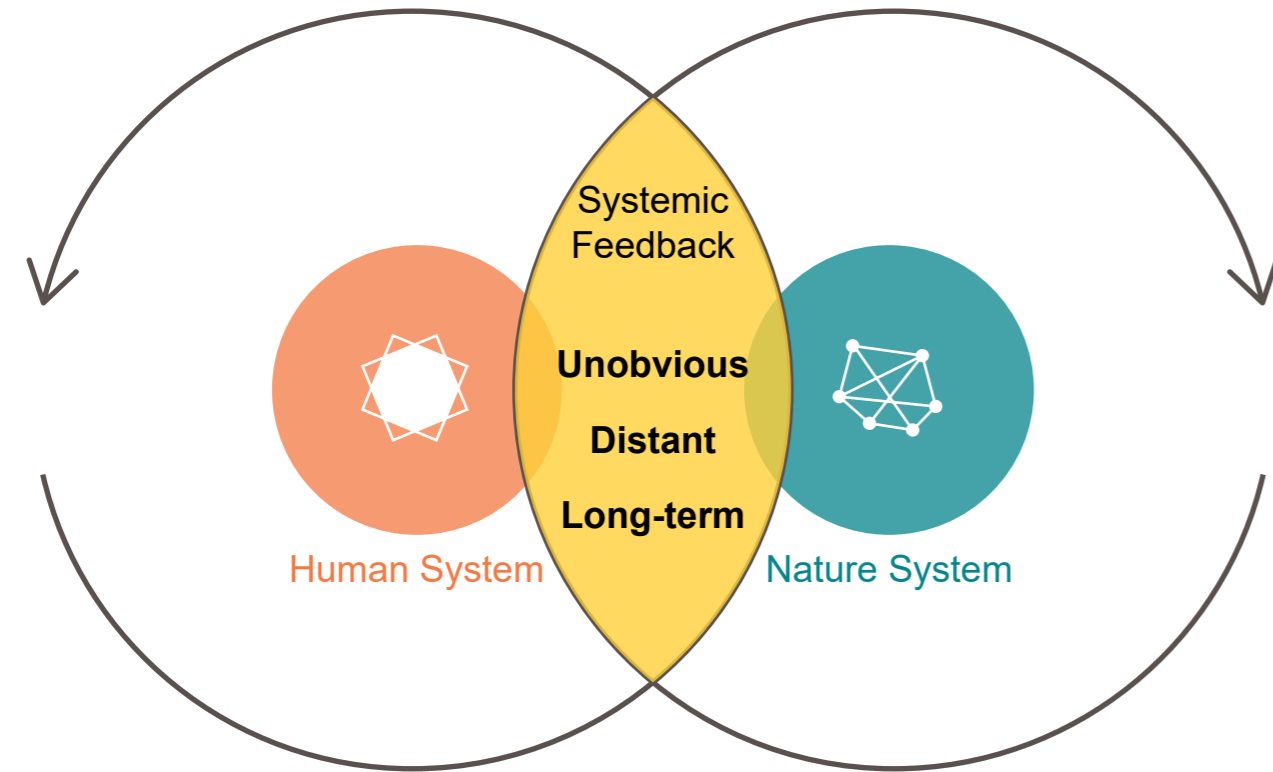
The rapid change in human activity began with the industrial revolution in the 1760s. The explosive population growth and the rapid development of economy have caused the rapid expansion of human demand for energy, resources and land, which has caused unprecedented impact on the ecological environment. The interaction between human and natural systems has increased significantly. Rapid economic development comes at the cost of the degradation of current and future ecosystems and services. These costs are often not immediately apparent. For a system, it takes time for the stock (the elements of the system that can be observed, sensed, counted, and measured at any given moment) to change, because it takes time to change its flow (the condition that changes over time) to work. The time lag caused by the slow change of stock in the system may cause some problems, meanwhile, they are also the root cause of system stability (Meadows, 2012). The interaction between human beings and the coupling system of nature also has a time lag. Organisms slowly accumulate the influence of the environment through heredity

and evolution, while the natural environment gradually accumulates and spreads the influence of human activities through the physical and chemical cycles. In addition, there are some cases where human beings lack the necessary research and technology to detect the corresponding indicators and cannot correctly understand the changes in the system. For example, until the end of 2010, most countries in the world were still testing for PM10 (particulate matter), and only the United States and some countries in the European Union monitored PM2.5 (fine particulate matter). In early 2011, the revised version of China's ambient air quality standard was put out for public comment, and only then did regions start to use PM2.5 as a reference index. Since then, it has gradually announced the implementation plan for testing, defined the Chinese name, and implemented the PM2.5 monitoring system in most cities in China. Since then, more attention has been paid to air quality and the harm of PM2.5.

Pre-Study Cognitive Limitations

Humans are often accustomed to neglecting systemic feedback that are unobvious, long-term, distant, and have never made it impossible to recognize and respond to the challenges we face.

But do you know how design defines the interaction?



Coupled Human and Natural System (CHANS)

Pre-Study Cognitive Limitations

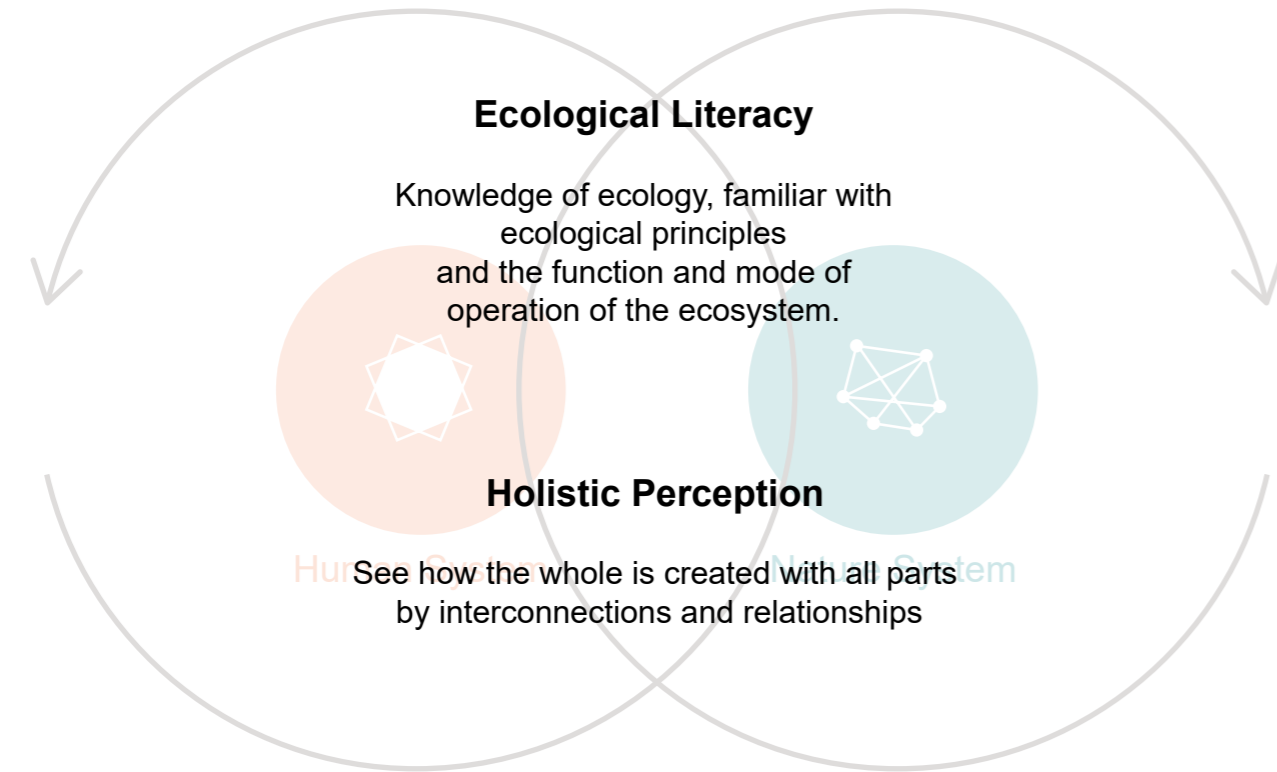
Because of the complexity of human-nature coupling systems in organization, space, and time, and because humans tend to ignore subtle, distant, and long-term system feedback, we have never been unable to collectively recognize and respond to the challenges we face.

The tendency of the western academic tradition to subdivide knowledge into smaller units is one of the root causes of people's slow response to problems. Since the industrial revolution, the mainstream mode of thinking in western society has gradually evolved into science, logic and "reductionism" as opposed to intuition and "holism", and has made great achievements. The thinking of reductionism constantly analyzes the research object, restores its original state, turns the whole into parts, and turns the complex into the simple. Under the influence of such thinking, the professional subdivision and mature social division of labor of the subject field make each person perform his or her own duties in his or her post, while they are indifferent to the changes in other fields. In 1959 C.P. Snow caused an academic sensation when he gave a lecture at Cambridge University entitled "two cultural and scientific revolutions". Snow pointed to the cultural gap between science and the humanities, or the separation between "art" and "science," and the mutual ignorance of each other's fields." This polarization is absolutely a loss for all of us."(Snow, 1990) and has never been resolved. Fifty years later, Paul Enrich and Anne Ehrlich (2010) continued the discussion on this topic in an article entitled "the cultural gap that needs to be closed", in which they described how individuals in advanced societies possessed one billionth of the information of the entire society." Key parts of the gap must be closed quickly in a robust response to issues such as climate damage, environmental pollution, loss of biodiversity and ecosystem function, and epidemiological environmental degradation," they call for. The most important thing is to change human behavior and put society on a sustainable path."

Despite the wealth of "knowledge" available online, what Enrich refers to as "the cultural gap" refers to the terrible collective ignorance that results from knowledge being divided into smaller units and specialties isolated from each other. How many of us know how oil refining machines work, or where our food comes from or how it is grown, etc. Worse, the way we subdivide knowledge means that even "brilliant decision makers cannot see the obvious and critical connections." Also forgivable. As a result, the crucial link between the deepwater horizon tragedy and humanity's "ridiculous, expensive, potentially lethal, ongoing oil dependence" has also been ignored. What's implicit in the cultural gap here is how are voters or politicians going to make decisions if they can't understand the co2 charts and how tech companies work, or if they don't understand resilience, tipping points, exponential growth and complex adaptive systems? Because our lack of so much knowledge blinds us to the connections and forms of the world, such "cultural gaps" leave humanity in such a fragile state that we remain oblivious to decisions that threaten our very existence.

This way of thinking determines that we cannot understand the systematic interconnectedness of problems. This isolated worldview constitutes a fundamental epistemological error that occurs frequently in education, media, politics, and law, leading to the industrial system quietly destroying the ecosystem on which mankind depends.

Holistic perception and ecological literacy can help us better build awareness of sustainability issues and find holistic, long-term solutions. The holistic perception is the biggest challenge in sustainable design teaching.



Source: ZHU X, LEUBA DIT GALLAND P. Building Up a Mindset of Design for Sustainability; proceedings of the Cumulus Conference Proceedings Wuxi 2018 Diffused Transition & Design Opportunities, Wuxi, China, F 31st October-3rd November, 2018 [C]. Wuxi, China, 2018.

Our way of knowing and our lack of knowledge limit our understanding of sustainable issues. In order to better understand and solve the sustainable problems faced by human beings, it is necessary to establish a common sense of sustainability. Specifically, we can quote Peter Stebbing (2016) pointing out two closely related knowledge abilities that are extremely important for building awareness of sustainability:

First, a holistic perception means to see how the whole is created through the connections and relationships that exist between all the parts. Rockstrom and Klum (2015) call it hyper-connectivity, which exists between everything. It is this connection and interdependence that enables nature to function, sustain and bear the burden of man. Holistic perception requires us to observe the world from a systematic perspective, think about the problem holistically, dynamically and continuously, and understand the problem in the corresponding situation, so as to find the root cause of the problem and see multiple possibilities, so that we can better manage and adapt to complex situations and seize new opportunities. This observation is not in conflict with reductionism. Human beings and nature themselves are real beings, not different because of the change in the way of observation. But from different perspectives, we can see different things. Each observation enriches our understanding of the world to meet the complex and rapidly changing challenges of sustainability. However, the perception of wholeness cannot be separated from the understanding of natural ecology.

Secondly, ecological-literacy refers to the understanding of ecology, and the familiarity with ecological principles and the functions and operation modes of the biosphere (Lemons & Orr, 1992). Ecological Literacy involves understanding the flow and circulation of energy and matter, the interaction of inorganic and organic matter with nature, their interdependence with the biosphere, and the dynamic balance of ecosystems. Few of us understand the fact that all human existence is

based on the biosphere. Extensive ecological awareness includes an understanding of human and social interconnections and relationships with natural systems (Cutter-Machenzie & Smith, 2003), the causes of environmental problems caused by human activities, a sense of action to participate in the protection of ecological sustainability, and an ability to objectively assess and adjust the way resources and energy are used. It also includes, on the emotional and spiritual level, tolerance of differences and diversity, care for and respect for other people and life, and curiosity and awe of nature (Capra, 1997). Ecological Literacy is also inseparable from the systematic way of thinking and the perception of connection and situation.

"We know that everything is connected to each other, just like blood ties to everyone in the family... What happens to the earth also endangers its children. Man is not the weaver of the web of life, he is only a strand of it. Whatever he does to the web of life will come back to him." (Perry, 1972) due to the complex interconnections, the knowledge system of sustainability is more like an intricate fabric, no matter you pick up a corner from it, you will find that it is connected with everything in the world. The two intellectual capacities of holistic awareness and ecological awareness can help us better build awareness of sustainable problems and find holistic, long-term solutions rather than isolated, temporary solutions.

Ryn and Cowan (1995) point out in their work *Ecological Design*: "in many ways, the crisis of the environment is a crisis of Design. It's the result of how things are made, how buildings are built, and how the landscape is used." In the era of mass production, everything in human society was planned and designed. Design is a powerful tool for innovation and change, with infinite possibilities. On the one hand, we can realize that design has caused the current crisis we are facing. But on the other hand, design also has great potential to solve these problems. The designer has the dual identity of being the inhabitant of the earth and the creator of the future (Zhu & I. d. G., 2018). This requires designers to assume a high degree of social and moral responsibility (Papanek, 1991), as well as a sense of sustainable design. Therefore, in the teaching of the concept of sustainable design, we should first pay attention to the cultivation of the two knowledge abilities of overall perception and Ecological Literacy mentioned above. In addition, it is necessary to change the original design concept and provide more meaningful learning content for learners from the perspective of teaching sustainability.

Connotation of Sustainable Design and Change Of Design Concept

Design for sustainability has long been understood as reducing the consumption of earth's resources and energy to reduce the impact of design on the environment. This means that a design should aim to achieve minimal environmental impact. These effects can be measured by eco-footprint and eco-rucksack. Ecological footprint refers to the area of biological productive land or water area required by a certain number of people according to the resources required by a certain lifestyle and the absorption of derived wastes under the condition of prior art (Wackernagel & Rees, 1996). The ecological burden refers to the

difference between the amount of materials not directly entering the trade and production process and the weight of the product in order to obtain useful substances and produce products (schmidt-bleek, 2008). But even with a small environmental impact, design is still an expense and a burden to the environment. The reality is that humanity is already burdened with a heavy environmental debt. As stated at the beginning of this paper, the date of human consumption of the year's natural productivity budget in 2018 is August 1. After this date, human consumption of natural capital (Global Footprint Network, 2018) is excessive, and the date is expected to be advanced to June by 2030. Sustainable design that simply reduces the use of natural resources will still place a heavy burden on the planet. So the real design challenge for us should be how we design and live to increase the natural capital of the planet. Stebbing (2016) refers to this design strategy as "Positive impact design" and defines it as being able to increase the natural capital of the earth while designing, that is, it is more natural after the design intervention than before the intervention. For example, if you cut down a tree to build a house, plant five trees for the future. Although this may sound difficult to achieve, we must change from the fundamental consciousness and strategic approach of design to achieve true sustainability. As Einstein said, problems cannot be solved by thinking in the way of creating them.

Thinking Mode Vs Technical Method

As a very comprehensive subject, sustainable design covers a lot of interdisciplinary knowledge and involves many design strategies, technical methods and evaluation methods. But when students are not set up the Holistic Perception on sustainable and Ecological Literacy of the cognitive basis, specific sustainable design methods

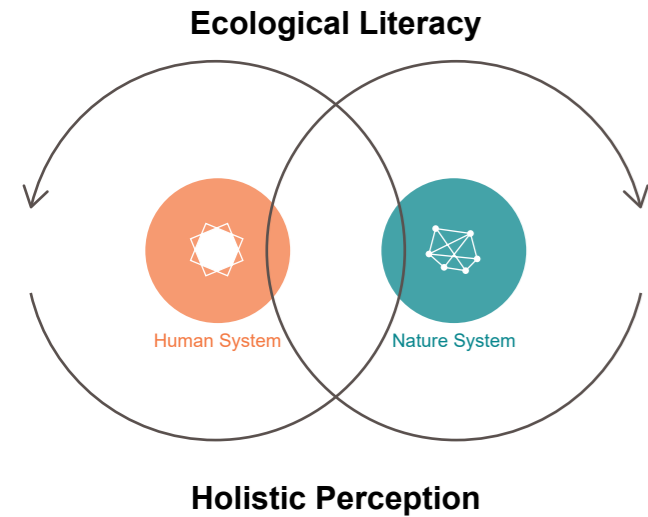
of teaching will only make the most of the students felt too technical and boring, just think of it as inspiration for an option or even just "increase the flavor of the design" (Zhu & I. d. G., 2018), most of domestic design institutes in the teaching on both feel difficult to put it into the curriculum itself, or tend to regard it as a door "decorative" elective subjects in the course to handle (Leong & Lee, 2014). As a result, the teaching of sustainable design cannot get enough attention from design students and teaching managers.

Zhu and Leuba Dit Galland (2018) pointed out in their study "Building up a mindset of Design for Sustainability" that Sustainability should be the starting point and core of Design and its teaching for the benefit of human beings, rather than the addition or supplement in the process. More important than the teaching of specific design methods and tools is the cultivation of sustainable consciousness and way of thinking. Due to the diversity of technical means, not only will the technology be updated with the development of society in time, but also be limited by regional differences in space, and will be widely different due to the specific background of the project. The sustainable consciousness and thinking method can be transferred to any design scene and directly guide the designer's observation research and design practice. Young provide plasticity design major students' values, such as in sustainable design teaching introduced in the whole thinking mode of perception and cognition, the basis of Ecological Literacy to exercise a systemic view of the problem, learn to distinguish the real sustainable design and "floating Green (Green washing, refers to the false propaganda of environmental protection)", may be more practical significance. In time, students will be able to practice this sustainable way of thinking in their future design, work and life, to carry out research and design according to local conditions and find specific solutions by applying appropriate sustainable design tools. Therefore, the author believes that the study

of Sustainability Design Consciousness, which is based on the thinking mode of overall perception and basic cognition of Ecological Literacy, among students majoring in design, may not produce immediate results in a short period of time, but it will have a lasting and far-reaching impact on these future designers.

Pre-Study
Current Curriculum Settings

How the course is set to meet the goal of knowledge and ability?



外部线上数据库: 微信公众平台 External Online Library: WeChat Public Platform

内部线上数据库 Internal Online Library: Teambition

参考书目
Reference List

辅导
Tutorial

实地考察
Field Trip

B 人类系统 Human System

1. 制造与废弃 Production & Waste

- 📌 收集记录三天的生活垃圾
Collect all your trash in 72 hours
- 📌 上海垃圾路线追踪
Track the trash routes in Shanghai
- 📌 校园垃圾调研
Survey of waste on campus

2. 健康与饮食 Health & Food

- 📌 研究你最喜爱的食物
Study one of your favorite foods
- 📌 健康饮食App调研
Search for APPs on healthy diets

3. 空间与交通 Places & Mobility

- 📌 校园道路步行适宜度调研
Study on walkability on campus

A 导论 Introduction

- 📌 计算自己的生态足迹和地球过载日
Calculate your own ecological footprint/earth overshoot day

系统思维
Systematic Thinking

D 为可持续而设计 Design for Sustainability

1. 工具 Tools —— 生命周期评估 Life Cycle Assessment
2. 方法 Methods —— 仿生学设计 Inspiration from Nature
3. 评估 Evaluation —— 可持续设计评估 Evaluation on DfS
4. 案例 Cases —— 循环经济 Circular Economy

C 自然系统 Natural System

1. 空气 Air
2. 水体 Water
3. 土地 Land

📌 从我们日常生活中的衣、食、住、行、弃等诸多方面,选取其中一个侧面(一个具体的物品/材料/行为等),研究人类行为对环境的影响,关注的焦点分别是自然环境系统中的三个方面:大气、水体、土地。并结合相关的设计手段,进一步探索潜在的设计干预方向、策略,以修复或再生被破坏的环境。

Choose one aspect from the human system (Clothing/ Food/ Places/ Mobility/Waste) to study the impacts on the natural system; focusing on one of the environmental mediums (Air/Water/Land) to learn what dangers we face, what their causes are and how to render them harmless. If possible, explore potential design interventions to restore/ regenerate the environment, i.e. render the impacts positive.

展览: 不同视角下的的可持续议题 Exhibition: Sustainability from Different Perspectives

Pre-Study
Current Curriculum Settings

By observing and recording the course and communicating with the course lecturer Zhu Xiaocun, the author collected the basic information about the current situation of the course "Sustainability Design Consciousness". The following is an example of the "Sustainability Design Consciousness" course in the fall semester of the 2018 academic year, which summarizes the main elements of the knowledge product service system provided by the course. As shown in figure 4.1, the course provides lectures, tutorials, field research, bibliography, exhibitions, online databases, etc. Students will be able to produce classroom exercises, research projects, etc. Lectures, assignments, research projects and exhibitions constitute the main content of the course (shown as a solid color rectangle in the figure). Students realize the knowledge construction related to the concept of sustainability through frequent interaction with teachers and other students. Tutorials, field research, bibliographies, and online databases are supporting content (shown as rectangles in the figure).

In the diagram, a yellow border is used to demarcate the systematic boundary of the course, which is used to distinguish the teaching activities and the knowledge exchange facing the outside world between the teachers and students attending the course. It is known that the external online database and exhibition are the main channels of communication between the course and the outside world. In this study, the field visit is regarded as the on-spot course teaching, which is only the transfer of classroom space and still belongs to the teaching activities within the course system.

Lecture: the content of the lecture is divided into the following modules: first, the introduction class, namely why to design for sustainability, introduces systematic and critical thinking methods, and emphasizes the complex connection between human system and natural system; Next is the human system module, which studies the relationship and

influence between human activities and natural environment from three aspects: manufacturing and waste, food and health, space and mobility. Then there is the natural system module, which explains the operation mode of the ecosystem and the consumption or pollution of natural resources from three aspects: air, water and land. Finally is "designed for sustainable" module, from the life cycle assessment of specific tools, represented by the bionics design of sustainable design method, is given priority to with sustainable design review and certification of standard and guide the development of the market standard interpretation, case study on circular economy introduced four perspectives for sustainable strategy method and the design method of the environmental impact assessment. This module is mainly for guest lectures and is open to the public.

Assignments: after each of the three sessions in the "human systems" module, students are required to complete the corresponding assignments after each session. For example, in the "manufacturing and waste" course, students can choose between "collecting and recording personal household garbage for three days", "tracking the flow of garbage in Shanghai" and "investigating campus garbage". These assignments are done by groups of two or three people over the course of one week and the best of them will be presented before the next week's class.

Research project: starting from the third week, students will work in groups of three for six weeks. The research topic comes from the aspects of daily life such as clothing, food, places, mobility and waste. Students will choose a specific object, material or behavior in one of the aspects to study the impact of human behavior on the environment. The focus is on the air, water and land in the natural environment system. On this basis, potential design intervention directions or strategies are further explored to repair or regenerate the damaged environment, i.e. to

Pre-Study Current Curriculum Settings

achieve positive environmental impact.

Tutorial: in addition to lectures, students can ask questions and communicate with the teaching team in their spare time. Before the end of the class, there is a special question-and-answer session for students to discuss the progress of the research project with the teaching team in turn.

Reference list: the reference list, film and television materials and related information channels related to this course. These carefully selected books, documentaries, and sources of information will provide students with a broader or deeper source of knowledge than lectures, and can provide a wealth of resources to support assignments or project research.

Field trips: typically in the middle and later stages of the course, the professor will take students on a tour of case Spaces for local sustainable design practices, guided and explained by local project leaders.

Exhibition: the exhibition is a concentrated display of teaching achievements, as well as an opportunity to communicate with other people besides teachers and students in the course. The content presented is mainly about the better student research projects that have been further improved. The exhibition usually opens about a month after the course and lasts one to two weeks. The location is in the public exhibition space of the college. The audience is teachers and students of the college and some students from other colleges. Sometimes, teachers and students of design major from other schools will come to exchange and study.

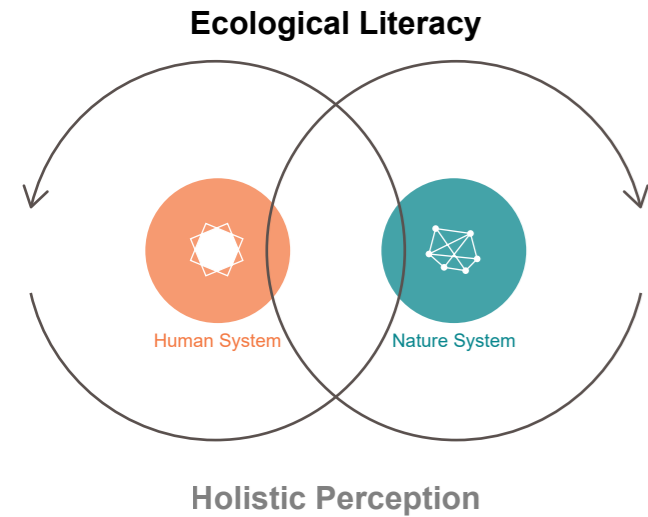
Online Database (Library): online database is a platform to store and display teaching materials and student work. There are two databases

that the course is currently using. First, Teambition for in-class file sharing, an online team collaboration tool that supports information exchange, file sharing, and task management. The other is the WeChat public platform for external sharing, maintained by dedicated student teaching assistants, which regularly edits and publishes information on outstanding student research projects and public lectures, presentations and exhibitions.



Pre-Study
Current Curriculum Settings

The lectures on human system and natural system offer knowledge on ecological literacy.



外部线上数据库: 微信公众平台 External Online Library: WeChat Public Platform

内部线上数据库 Internal Online Library: Teambition

参考书目
Reference List

辅导
Tutorial

实地考察
Field Trip

B 人类系统 Human System

1. 制造与废弃 Production & Waste

- 📌 收集记录三天的生活垃圾
Collect all your trash in 72 hours
- 📌 上海垃圾路线追踪
Track the trash routes in Shanghai
- 📌 校园垃圾调研
Survey of waste on campus

2. 健康与饮食 Health & Food

- 📌 研究你最喜爱的食物
Study one of your favorite foods
- 📌 健康饮食App调研
Search for APPs on healthy diets

3. 空间与交通 Places & Mobility

- 📌 校园道路步行适宜度调研
Study on walkability on campus

A 导论 Introduction

- 📌 计算自己的生态足迹和地球超载日
Calculate your own ecological footprint/earth overshoot day

系统思维
Systematic Thinking

D 为可持续而设计 Design for Sustainability

1. 工具 Tools —— 生命周期评估 Life Cycle Assessment
2. 方法 Methods —— 仿生学设计 Inspiration from Nature
3. 评估 Evaluation —— 可持续设计评估 Evaluation on DfS
4. 案例 Cases —— 循环经济 Circular Economy

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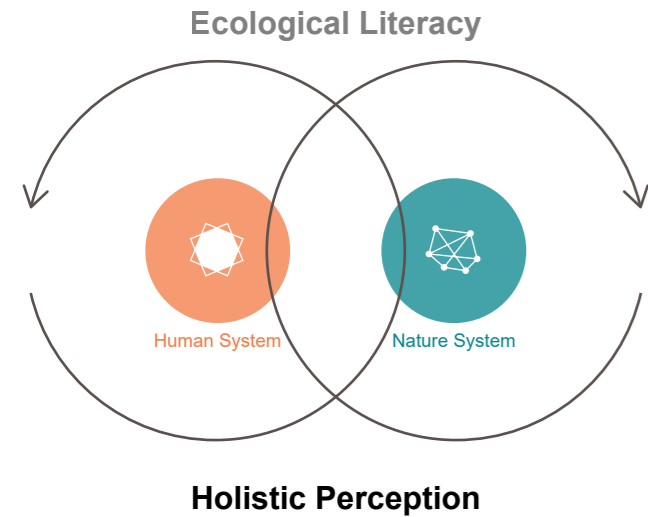
展览: 不同视角下的的可持续议题 Exhibition: Sustainability from Different Perspectives

Pre-Study
Current Curriculum Settings

In terms of Ecological Literacy, students need to establish a certain understanding of ecology, be familiar with ecological principles and the functions and operation modes of the ecosphere, as well as the relationship between human and society and the relationship with nature. Through the analysis of the course content, it can be found that the course provides students with more comprehensive knowledge resources of Ecological Literacy. From the content of the lecture, on the one hand, students can understand the impact of human activities such as manufacturing, diet and transportation on the environment in the lecture of human system module. For example, the lesson "manufacture and waste" introduces how the waste produced by human beings and the toxins and pollution generated by the materials in it affect human health through food and other ways, the long-term harm brought by the landfill disposal method, as well as the contents of e-waste and garbage globalization. On the other hand, students can learn the principles and operation modes of ecological environment from lectures on natural systems module, as well as. For example, the lesson "air" introduces the importance of air to human survival, the rise of local pollution as a global problem by atmospheric circulation, the principle of greenhouse effect and the impact of climate warming on human activities, and the concept of global carbon emission trend and carbon footprint. In addition, students will learn more about the interrelationship between human activities and the environment through personal experience or active research during classroom exercises, visits and research projects. Recommended reading lists and films such as "silent spring" and "an inconvenient truth" also provide students with access to relevant knowledge. Therefore Ecological Literacy is an important part of curriculum knowledge.

Pre-Study
Current Curriculum Settings

The research project and reference embed holistic perception in students' mind.



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课内学习
系统边界
课外交流

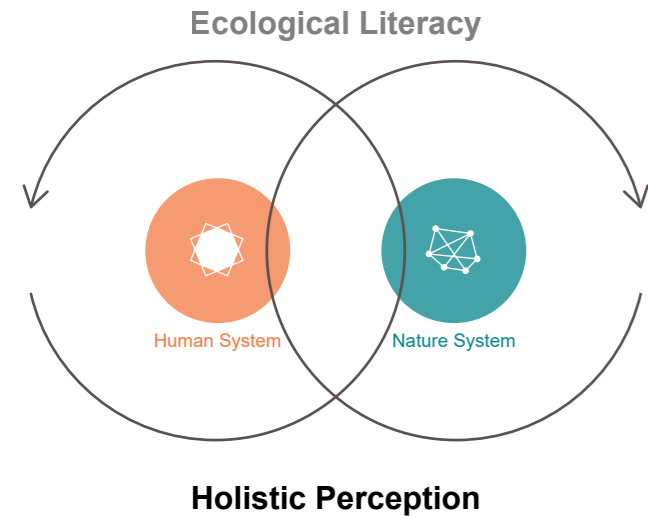
展览: 不同视角下的的可持续议题 Exhibition: Sustainability from Different Perspectives

Pre-Study
Current Curriculum Settings

In terms of Holistic Perception, students need to see the connections that exist between the parts and how those connections create the whole. In other words, develop a systematic mindset. Through observation and communication with the lecturer, it can be found that in the course of "Sustainability Design Consciousness", there are many ways to cultivate systematic thinking. In addition to lecture in the form of a direct introduction of systems thinking method, and by introducing a system of tools, life cycle assessment method, guide students from the perspective of whole life cycle from raw material extraction, processing and manufacturing, the connection between the products used to dealing with all of the chain and comprehensive considering every link of the earth's ecosystems, climate change, energy use, resource consumption, the impact of human health, etc. In addition, on the module arrangement of lectures and the requirement setting of research projects (figure on next page), we can find that the knowledge structure of the course content is built on the two dimensions of human system and natural system, emphasizing the relationship and influence among them, and on this basis, we can understand the strategies and methods of research or design from the perspective of design. This leads students to explore the interaction between the two systems and discover the connection between all things. In addition, such a setting also helps students to collaborate and experience the operating mode of the system in practice. This aspect is detailed in the following analysis of student research projects. Other aspects provide the knowledge input of Holistic Perception, such as the reference list of the beauty of systems, cradle to cradle, and other recommended readings on systems thinking. Thus, system thinking is the basic logic throughout this course.

Pre-Study
Current Curriculum Settings

Students' research projects are set on the crossing space of human and natural system, It is designed to guide students to discover the connections between everything through collaboration.



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"Sustainability Issues from different Perspectives"

Frame of research projects

自然系统 Nature system	辅导 Tutorial	实地考察 Field Trip
空气 Air	生产与浪费 Production & Waste	计算自己的生态足迹 Calculate your own ecological footprint
水体 Water	衣食住行 Clothing, Food, Places, Mobility	评估 Evaluation
土地 Land	案例 Cases	循环经济 Circular Economy

潜在的设计手段
Design approaches

衣 Clothes, 食 Food, 住 Places, 行 Mobility, 弃 Waste

人类系统
Human system

从我们日常生活中的衣、食、住、行、弃等诸多方面, 选取其中一个侧面 (一个具体的物品/材料/行为等), 研究人类行为对环境的影响, 关注的焦点分别是自然环境系统中的三个方面: 大气、水体、土地。并结合相关的设计手段, 进一步探索潜在的设计干预方向、策略, 以修复或再生被破坏的环境。

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展览: 不同视角下的的可持续议题 Exhibition: Sustainability from Different Perspectives

Chapter
Sum

This chapter first illustrates the importance of environmental sustainability from the definition and mode of sustainable development. It then illustrates the necessity of establishing a sustainable consciousness in terms of the complex coupling relationship between human and nature in time, space and organization, and human cognitive habit of ignoring indistinct, remote, long-term system feedback. Furthermore, two closely related knowledge abilities which are very important to the teaching of sustainable awareness are put forward, namely holistic perception and ecological literacy. Then I focused on the teaching of sustainable design consciousness, and explored the connotation of sustainable design based on the characteristics of design that can either caused environmental crisis or solving it. From the teaching content, it is pointed out that compared with the study of specific technical methods, the cultivation of sustainable design consciousness based on the holistic perception and the basic cognition of ecological literacy has longer-term significance for design students.

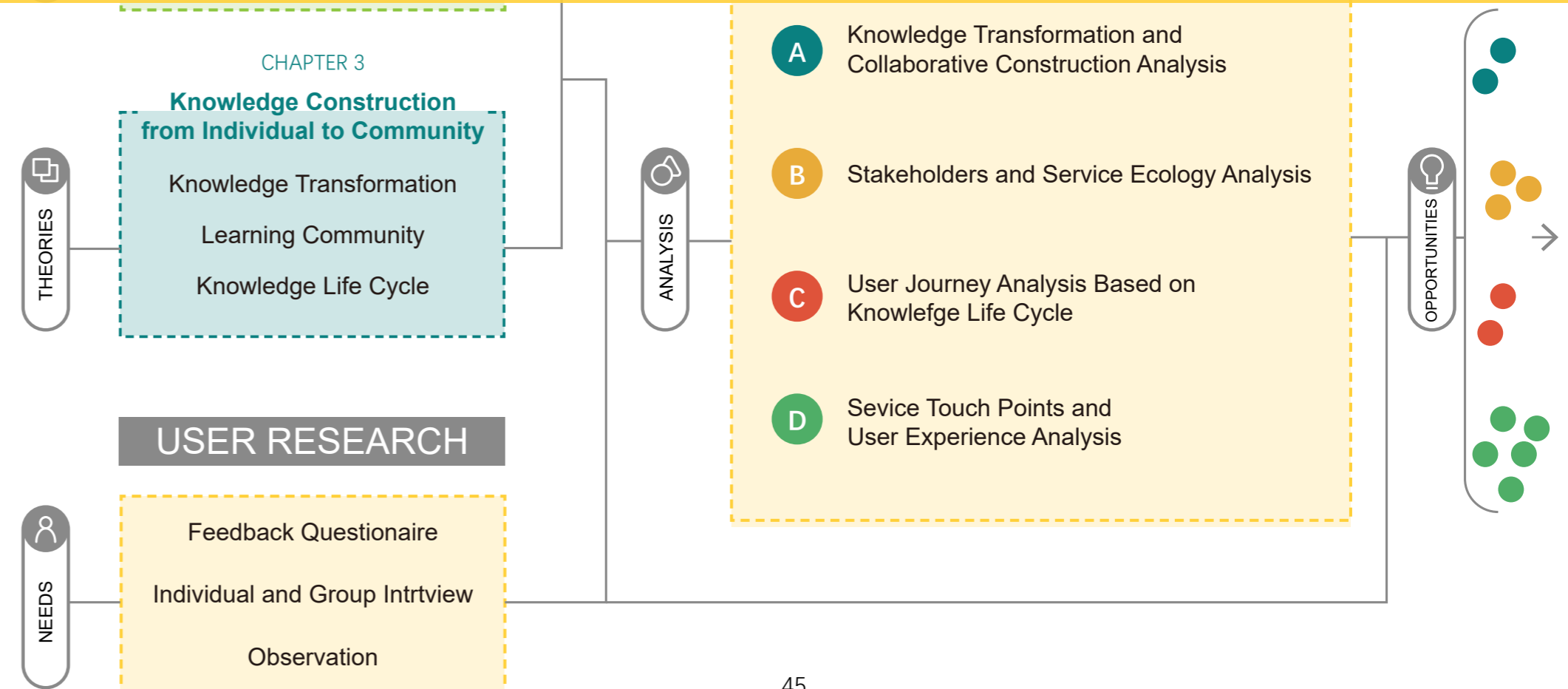
Key questions

From the perspective of learners, how effective the knowledge product service system of the course works?

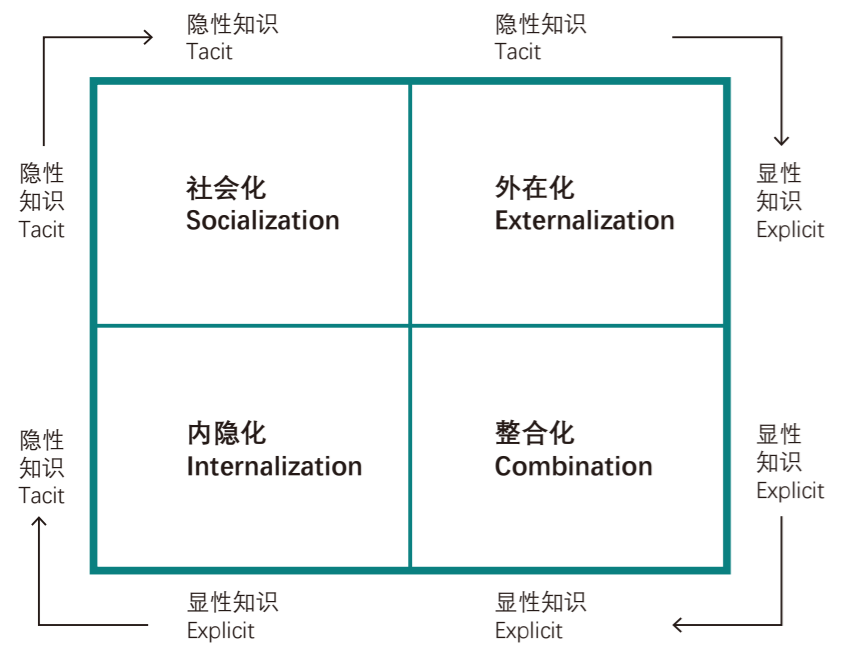
How can we better achieve learning goals of ecological literacy and holistic perception?

2. Case Analysis

How to analyze the system status and user needs from the perspective of service design and knowledge construction?



Learners need to establish a continuous and effective transformation mechanism of explicit and tacit knowledge, so that the knowledge system can be continuously improved.



Explicit Knowledge

Formal, structured, institutionalized, standardized, and formatted. Can be coded and managed.

Tacit Knowledge

Personalization, subjectivization, socialization. It is difficult to describe and express in words, and it needs to be shared through frequent interactions.

SECI (Socialization-Externalization-Combination-Internalization) Model

Source: NONAKA I. A Dynamic Theory of Organizational Knowledge Creation [J]. Organization Science, 1994, 5(1): 14-37.

Knowledge Transformation

Constructivism thinks that knowledge is the dominant (explicit and implicit (tacit) of two dimensions woven (Polanyi, 1966). Explicit knowledge is the knowledge that the subject creates to solve problems in the process of rational thinking and transmits knowledge in a formalized, structured, institutionalized, standardized and formatted way, which can be coded and managed. Invisible knowledge is more personal. It is the mental feeling and personal experience of the subject, which is difficult to be described and expressed in words. It emphasizes the social attribute of knowledge and requires frequent interaction to realize the sharing of knowledge. What we mean by creativity lies in the hidden dimension of unsolidified knowledge.

Nonaka (1994) developed the SECI (Socialization-Externalization-Combination-Internalization, Socialization-Externalization- combination -Internalization) model (figure on the left) to explain the flow and transformation process of knowledge in the dominant and recessive dimensions. The transformation of explicit knowledge and tacit knowledge includes four processes: socialization, externalization, combination and internalization. Socialization is the flow process of tacit knowledge, that is, to acquire tacit knowledge behind external information, and realize the flow transfer of tacit knowledge within the organization through mutual observation and frequent communication and interaction among members. Externalization is the process of transforming tacit knowledge into explicit knowledge. It is the process of transforming tacit knowledge, such as experience and skills, into explicit knowledge that can be expressed in language or words, and transforming the knowledge originally belonging to individuals into community knowledge. Combination is the flow process of explicit knowledge. The explicit knowledge is processed, sorted out and summarized with knowledge management tools to transform it into

another explicit knowledge that is easier to acquire. Internalization is the transformation process from explicit knowledge to tacit knowledge, that is, individuals expand and reconstruct the original tacit knowledge system by learning explicit knowledge, so as to further improve the knowledge structure.

The SECI model has an important knowledge spiral. It is a spiral of knowledge innovation that improves the knowledge and skills of the community. The knowledge spiral expands with the organization of individual knowledge. Knowledge starts from individuals and increases continuously through the interaction between people, so that individual knowledge is expanded and presented within the scope of the organization, and then transformed into a part of the knowledge network system within the organization (Lu Xiongwen, 2013).

Applying the SECI model to the study of learners' knowledge construction process, Qi Yu and Liu Song (2010) pointed out that learners' cognitive process mainly has the following characteristics:

First, the basis of the construction of individual knowledge system is tacit knowledge. The learner has a large number of individual concepts, emotions, and experiences. These tacit knowledge constitute the main frame of individual knowledge system and determine the difference of individual cognitive experience.

Secondly, the construction of knowledge system must go through the process of mutual transformation of explicit and tacit knowledge. Among them, the process of implicit explicit knowledge is the premise of knowledge innovation and cognitive structure development. From another point of view, the process of explicit tacit knowledge is a necessary condition for the dissemination and application of knowledge. Therefore, the formation of learners' knowledge system is a process in which explicit knowledge and tacit knowledge transform each other and

the original knowledge system is constantly improved.

Thirdly, explicit and tacit knowledge play a role in the process of knowledge construction. On the one hand, explicit and tacit knowledge are in essence a whole integrated with each other. The explicit knowledge that a learner can express is based on the tacit knowledge he has mastered, and the explicit knowledge reflects the richness of his tacit knowledge. On the other hand, the process of explicit tacit knowledge will help an individual transform his tacit knowledge so as to improve the efficiency of individual knowledge construction and understanding. This is what we often refer to as organizing and transforming knowledge through conscious manifestation.

It can be seen that the transformation of explicit and tacit knowledge in learners' cognitive process does not fully conform to the rules of the spiral process of socialization, externalization, combination and tacit knowledge, but presents a discontinuous or leaping form. However, it is certain that learners need to establish a continuous and effective transformation mechanism of explicit and tacit knowledge, so as to continuously improve the knowledge system.

Collaborative Construction

In the traditional educational concept, the fundamental goal of learning is to increase the individual's knowledge. With the emergence of the idea of knowledge construction developed from social constructivism, the focus of educational concept gradually shifts to the construction and optimization of community knowledge. Refer to the definition of community in sociology: "community is a human group and its activity area that carry out certain social activities and have certain interactive relationship and common cultural support. (Zheng Hangsheng, 2003) the author defines a learning community as a network in which a certain number of learners interact socially and share a sense of belonging and

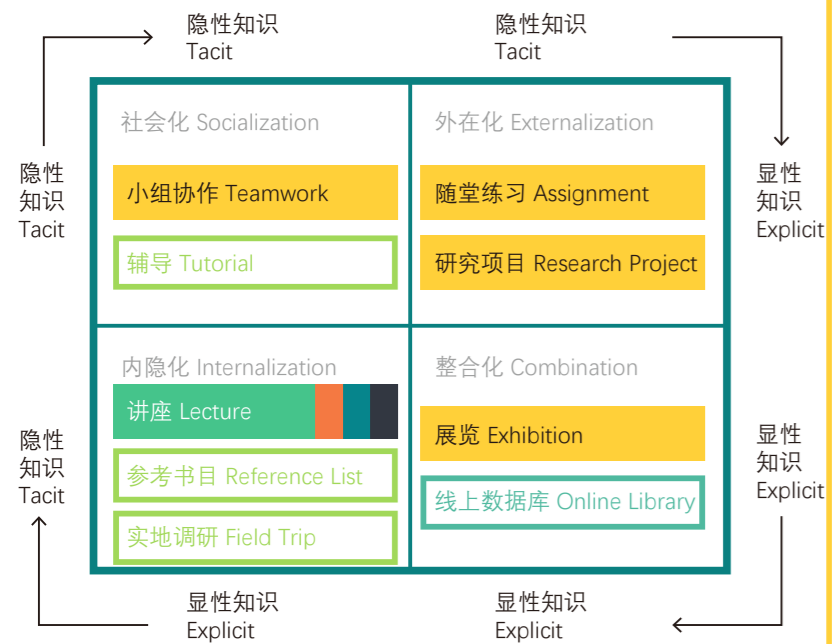
identity in a common activity area (activity space can be physical space or network space). Social interaction is the core feature of the learning community. The main members of the learning community are students who work together to build and improve their knowledge (Bielacyzc & Collins, 1999). In the process of knowledge construction, new knowledge is not merely assimilated or accommodated by the individual knowledge system by relying on the help of others (with more knowledge), but constructed in the process of solving problems together with peers (Zhao Jianhua, 2007). In the classroom teaching activities, students establish mutual understanding in the fields under discussion through group cooperation and communication and collaboration among students, realize the socialization, externalization and combination of knowledge, and then complete the implicit of individual knowledge and the construction of community public knowledge. Mclean (1999) believes that knowledge construction is a learning theory that emphasizes the collaborative construction of knowledge by group learners. Conceptual content produced in the process of knowledge construction can be viewed as an important product, because community members can use this content as a beneficial tool for knowledge development. The goal of knowledge construction is to produce public knowledge with specific value in the learning community, rather than simply enhance the tacit knowledge stock of individuals. Therefore, knowledge construction is suitable for collective or community work and activities, and the core of learning is how to promote learners to be knowledge constructors.

Mclean (1999) regarded knowledge construction as a concept and practice, and on this basis proposed the main principles of knowledge construction, including: knowledge construction is the activity of the whole learning community; It includes continuous and in-depth research activities aimed at specific issues; Such inquiry activities are

active and self-directed, usually in small groups and driven by questions from students. Shared understanding of goals; Mainly through the collaboration and repeatedly strengthen and carry on the coordination to realize the viewpoint consummation; Teachers are facilitators and expert learners of learning, but they do not represent all the knowledge resources.

To sum up, knowledge construction is a new thought and mode. It believes that the goal of teaching not only includes the acquisition of individual knowledge, but also is related to the knowledge refinement, innovation and development of common learners, and emphasizes the importance of knowledge formation through the transformation of explicit and tacit knowledge in the learning community. Individual learning belongs to a certain learning community. The premise of individual learning is to learn the knowledge construction in the community. For the scenario of collective teaching in design colleges, knowledge construction can provide a new research perspective and practical guidance for the cooperation between learners and the improvement of individual knowledge system.

There are many forms of knowledge transformation in current curriculum.



According to the previous analysis, it is necessary to establish a continuous and effective transformation mechanism of explicit and tacit knowledge, so as to continuously improve the knowledge system of learners, promote the flow of individual knowledge and community knowledge, and realize the collaborative construction of knowledge in the learning community. In the following part, the author will analyze the transformation process of explicit knowledge and tacit knowledge experienced by learners in teaching activities from the perspective of students.

Firstly, students acquire knowledge related to sustainability from teachers or the external environment through lectures, reading bibliographies or participating in field visits. Through the process of implicit explicit knowledge, students can expand and reconstruct the original tacit knowledge system. Then, during the classroom practice or research projects, students communicate with teachers through tutorial sessions, or discuss with group members in group discussions, and realize the flow and transfer of knowledge within the learning community through the process of tacit knowledge socialization. Subsequently, the sustainable knowledge acquired by students is presented in written form through assignments or research projects and orally expressed through reports. Through the process of externalizing tacit knowledge, the knowledge of individuals or groups is Shared in a larger learning community. Finally, teachers and students work together to further process and sort out the research project, and through the process of integrating explicit knowledge, make it become more accessible explicit knowledge, flow within the learning community through exhibitions or online databases, and spread to the outside of the learning community.

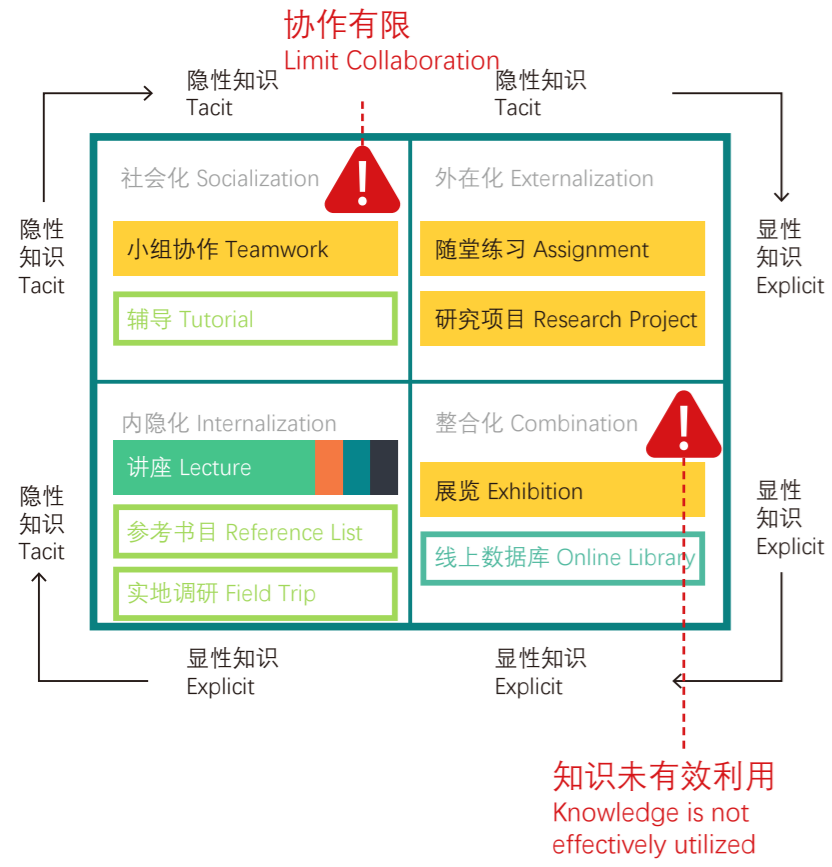
In the actual learning process, the above processes will overlap with each other. For example, during the six-week research project, students will master relevant sustainable knowledge through the implicit process

of explicit knowledge such as lectures, reading and active searching of materials, as well as the socialization process of tacit knowledge such as communication and discussion with peers and teachers. In the middle of the course, students will present their research intention and research direction to other students and teachers in the form of public report. The teaching team will make comments and Suggestions on the spot. This process of explicit tacit knowledge will help students to consciously organize the knowledge they have mastered, so as to improve the efficiency of knowledge construction and understanding.

At present, the collaborative construction of knowledge in teaching activities mainly takes place around research projects. In the form of group, students will conduct joint exploration in independently selected subject areas, establish mutual understanding, and realize the collaborative construction of knowledge within the group. However, there is currently no teaching service that supports knowledge collaborative construction in larger learning communities, such as classes or between previous students.

To sum up, in the current teaching activities, there are a variety of overlapping mechanisms of explicit and tacit knowledge. Among them, the integrated explicit knowledge in online database or exhibition is a knowledge source that has not been effectively used by students, so the implicit process of this part of explicit knowledge can be designed on the basis of the existing mechanism. In addition, it can further promote the collaborative construction of knowledge in the learning community from the form of cooperative learning of research projects.

However, knowledge in exhibitions and databases is not being used effectively; students have only in-group collaboration and have not been able to form a wider learning community.



Part A-Summary

ANALYSIS ★ STRENGTHS ! WEAKNESS **OPPORTUNITIES** **KEY POINTS**

Knowledge Transformation

There are many forms of knowledge transformation ★
Some of integrated explicit knowledge has not been effectively utilized. !

A1 Based on the existing mechanism, **design the process of reusing the explicit knowledge** formed by the integration of teachers and students.

Collaborative Construction

There are in-group collaborations based on the research project, but there is no broader range of knowledge-building collaborative support services within the learning community. !

A2 Starting from the form of collaborative learning of research projects, **further promote the collaborative knowledge construction** in the learning community.



Characteristics of Service Ecosystem

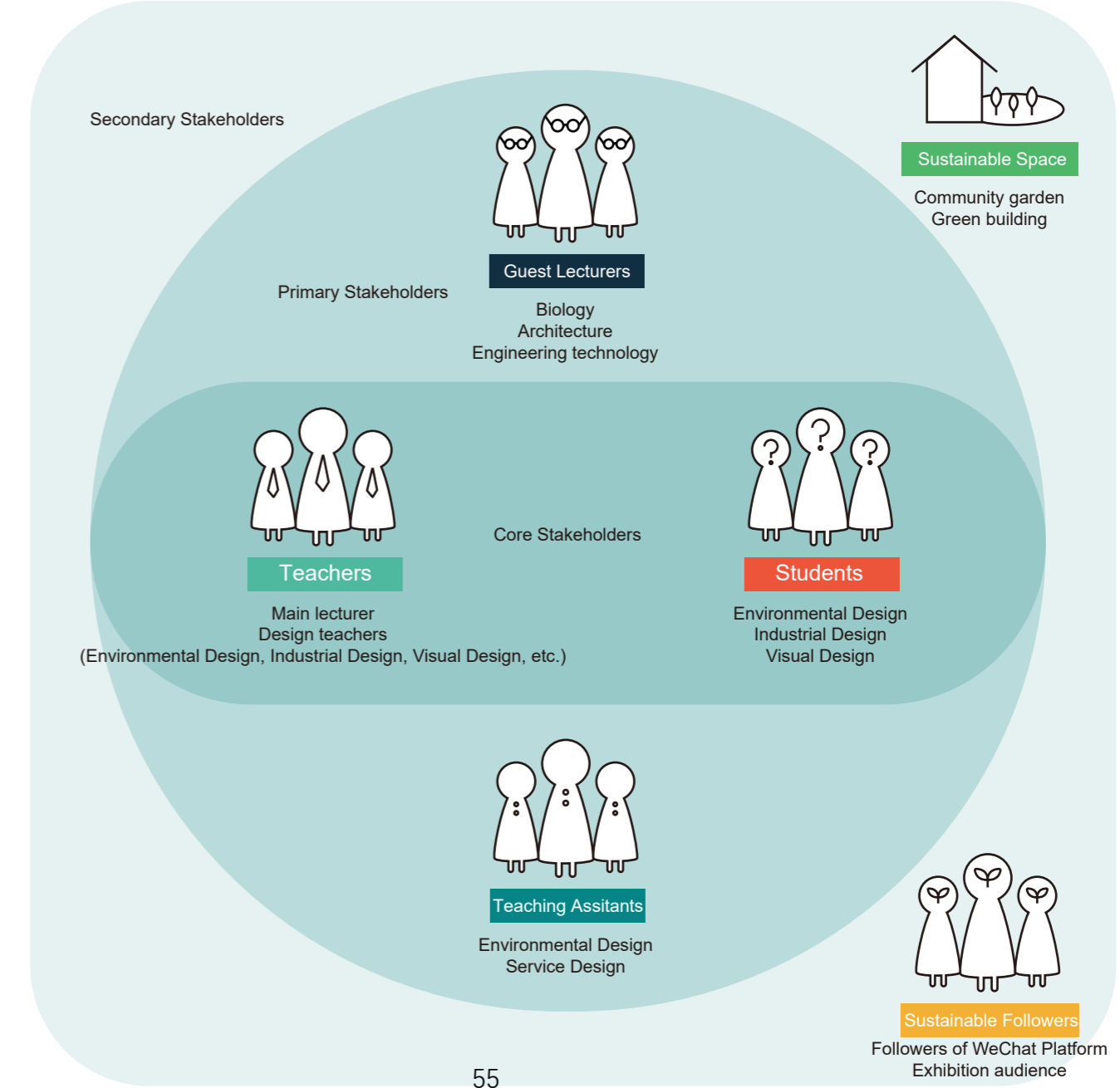
The service ecosystem includes the services made up of the participants and their relationships. Service ecosystems view services and the environment in which they operate from a systemic perspective. The service ecosystem covers all the participants affected by the service, not just those directly involved in production or use. Ultimately, the service ecosystem relies on the dynamic balance of the participants involved exchanging value in a mutually beneficial manner (Livework Studio Ltd). In other words, the service ecosystem is a relatively independent, self-sufficient and self-adjusting system, in which the participants are interrelated through the combination of resources, share the institutional logic, and create common value through the exchange of services (Vargo & Lusch, 2011), and at the same time have an exchange balance with the external system.

Like natural ecosystems, service ecosystems are characterized by close interrelationships and dependencies between their different parts. For example, in the intensive care unit, the work of nurses and doctors can be seen together in complementary ways, and the techniques they use in patient care extend and depend on each other, which constitutes the nature of the work of doctors and nurses. Moreover, ecosystem change is systematic. When one element in the system changes, the entire system is affected.

In a service ecosystem, there are different types of actors (who have different perspectives, values, and goals) and different types of tools. In a healthy ecosystem, they work in complementary ways. It is worth noting that diversity is essential for the health of the ecosystem itself, which will allow the system to persist and cope with possible chaotic changes (Nardi & O'day, 1999).

Stakeholder Analysis

People are at the heart of service. The participants in the knowledge service system are connected to become the network of stakeholders because of the mutual exchange of knowledge. According to the author's observation and statistics, stakeholders of "Sustainability Design Consciousness" course can be divided into the following categories:



B Case Analysis

Stakeholders and Service Ecology Research



The course of the fall semester of 2018 is a required course for the major. There are 92 undergraduates in the third year. The major distribution of the students is: 28 people in environmental design, 30 people in industrial design and 34 people in media communication design. The majors are evenly distributed.



The teaching team consists of one lecturer with a background in architecture and sustainable design and three professional teachers from industrial design, communication design and environmental design. The main lecturers are mainly responsible for the preparation, teaching and evaluation of the courses and the teaching methods. Teachers of design major will supplement their professional knowledge in teaching, student report, homework evaluation, exhibition and other links according to their professional background.



A teaching assistant team consisting of two third-year masters students and one student who took the course two years ago. Mainly responsible for the organization and recording of teaching activities and the provision of necessary technical support, as well as the communication between students and teachers. The teaching assistants' professional background is environment design and service design, which can provide students with certain professional knowledge support.



Experts from sustainable related industries or academic fields are invited as guest speakers to bring professional knowledge to teachers and students. During the course of the fall semester of 2018, a total of three expert lectures were held. Respectively by Tongji University college of life science and technology, a biology professor at the master's "natural revelation - from the perspective of ecological and evolutionary design", by the green building materials health and indoor air quality expert on "green building sustainable pursuit from China to the world - 17 years tour", and by the product life cycle impact assessment and sustainability of the supply chain experts on "how to evaluate a design life cycle impact on the environment".



In addition to the students who attend the course "Sustainability Design Consciousness", sustainability enthusiasts who participate in lectures, exhibitions and other related activities or browse the results of student research projects. They are mainly from the bionics sustainable design laboratory (WeChat) public platform of followers (as of February 2019, there are more than 500 followers) and from other sources to learn about the potential participants of open teaching activities. Given the current scope of the program, most of these concerns are with design majors at or outside of the school.



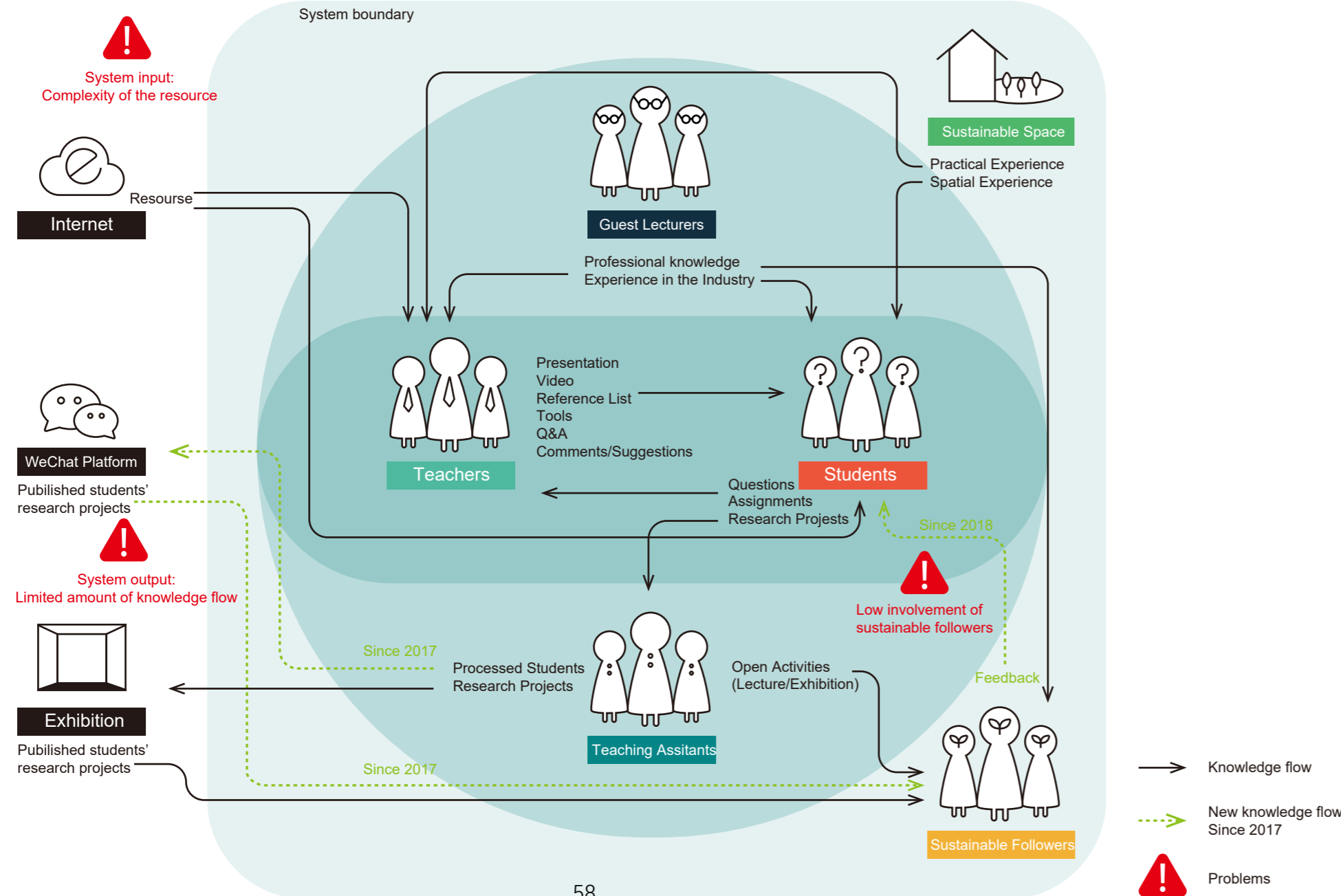
Case Spaces for students to conduct field trips to local sustainable design practices. Such as community gardens co-built by residents, large indoor commercial Spaces equipped with air purification and monitoring systems, health offices with zero energy consumption and zero carbon emissions, and organic crop production bases.

B Case Analysis

Stakeholders and Service Ecology Research

Among the above stakeholders, according to the importance of knowledge service system and the frequency of activities, teachers and students can be classified as the core stakeholders, guest speakers and teaching assistants as the main stakeholders, and sustainable practice base and sustainable concern as the secondary stakeholders. They form a knowledge product service system around the course "Sustainability Design Consciousness" through the mutual connection of knowledge and information.

Thus, the knowledge service system has gathered a certain number of participants with different functions. And diversity is the basis for the sustainable development of the system. Therefore, in the design of knowledge product service system, we can make full use of the existing multiple types of participants, find more diversified members in the same type of participants, and try to introduce new types of participants, so as to improve the diversity of the system, enrich the sources of knowledge and promote the flow of knowledge.



Service Ecosystem Analysis

In the knowledge product service system, there are complex relations and interdependence among the stakeholders. By analyzing the flow of knowledge and information between them, we can help to sort out the structure of the system and assess the health of the service ecosystem. Based on the observation of the course "Sustainability Design Consciousness" in the fall semester of the 2018 academic year, the author sorted out the services composed by the various participants in the system and their relationships.

First, there is a great deal of two-way knowledge flow between the core stakeholders, namely, teachers and students. On the one hand, the teacher through lecture, for students after finishing of reference list and the detail of the courseware, documentary or speech video clips and research tools and research project templates, and other products, and to explain the courseware, answer students' questions, coaching and comment on the students' in-class practice and research projects and other services, the flow of knowledge from teacher to students. On the other hand, students feedback their thinking and constructed knowledge to teachers by asking questions, submitting and reporting on assignments and research projects.

Secondly, there is a dependency and complementarity between core stakeholders and major stakeholders, mainly teachers and teaching assistants, teachers and guest speakers. Teachers and teaching assistants mainly complement each other in the organization of teaching activities and the integration of knowledge products. Teaching assistants assist teachers in the organization of lectures, Tours, and other activities that involve students and sustainable followers. Record and sort out the lectures provided by teachers and the research projects produced by students, so as to create conditions for the further dissemination

and utilization of knowledge products. In this way, teachers can focus more on providing high quality knowledge products and services for students. At the same time, the teaching assistants can get in touch with the knowledge products produced by teachers and students in different stages in the process of work, and realize the improvement of knowledge service ability. Teachers and guest speakers mainly present complementary content areas in knowledge products. Guest speakers come from sustainability related industries or academic fields. Through public lectures, guest speakers can summarize the cutting-edge practical experience of sustainable design in the industry or cross-disciplinary academic knowledge into easy-to-understand knowledge products and pass them on to students, teachers and sustainable followers. In this way, it provides students with professional and diversified knowledge input, complements the deficiencies of teachers in the field of knowledge content related to sustainability, and also provides an opportunity for sustainable followers to understand the professional knowledge related to sustainability. The guest can get some inspiration through the questions and discussions with students and teachers during the lecture. In addition, these guest speakers often have a vision to share and spread awareness of sustainability, which can help them reach more people through the campus platform.

Furthermore, secondary stakeholders, the sustainable practice base and sustainable followers, connect with other members of the system through low frequency or indirect interactions. In the field trips organized by teachers and teaching assistants, students can gain sustainable practical experience and direct spatial experience, and have the opportunity to communicate with project leaders for more information. Similar to the case of guest speakers, these Spaces have the mission of promoting sustainability awareness while practicing sustainable design and behavior. Through collaboration with institutions and programmes, the

scope of the sustainable practice base can be expanded. Sustainable followers can learn about open teaching activities such as public lectures or exhibitions through offline posters or online WeChat push channels, and participate in them at the appropriate time and place. During the lecture, sustainable followers and students alike can exchange questions with the guest speakers. In the exhibition, sustainable followers can browse the outstanding student research projects on public display and gain indirect access to the knowledge products produced by students.

Finally, there is a certain exchange of knowledge between the system and the outside world. On the one hand, teachers and students can obtain relevant resources and information through the Internet to organize teaching resources or carry out research projects. On the other hand, the research projects produced by students will be displayed online or offline through WeChat public platform, as an output of the system, and connected with the outside world.

Based on the above information, we can make a service ecological map of "Sustainability Design Consciousness" course. The text around each stakeholder in the figure represents the knowledge service it provides, and points to the receiver of the service through the arrow.

Combined with the figure above, we can assess the balance between the various players in the system and the flow of knowledge in and out of the system from the principle of mutual benefit of the service ecosystem.

Among them, students get a large amount of knowledge input from teachers, guest guests, practice base and the Internet, and realize knowledge output through questions, assignments and research projects, basically in a balanced state. Teachers provide students with a lot of knowledge input, at the same time from the in-class practice and study of the students, the output of knowledge, but also can with students to participate in the guest lectures and field of sustainable

practice base, (in lectures and field trips a year under the premise of content has updated) get some knowledge, and access to resources from the Internet, so basically in a state of balance.

In addition, the guests, the sustainable practice base and the teaching assistants all have a certain imbalance of knowledge flow income and expenditure. However, as mentioned above, they can balance the output of knowledge from other aspects such as ability improvement, inspiration and influence expansion, so they are not considered in this study.

It is noteworthy that in the course before 2018, the sustainable followers had almost only knowledge inflow, but no outflow, with a low degree of participation. Therefore, in the course of the fall semester of 2018, the author attempted to design and implement a series of knowledge services to obtain knowledge feedback from sustainable followers to increase participation, and hoped that students in the course could also benefit from the feedback from the outside. These used to get feedback of knowledge service include: invite research projects in the exhibition designer and question and answer directly to the audience, design project for students comments or thumb up toolkit, in exhibition and WeChat public platform set up ecological overload "earth day" test and the test results of all publicly real-time. Experimental results show that only a small number of sustainable followers actively use these knowledge services to provide some feedback. For example, only 7 out of 138 viewers who voted on the WeChat public platform for a post containing the test published their results. The communication between sustainable followers and students is also dominated by one-way knowledge flow. According to the author's observation, the scene was mainly explained by the students, and several audience members raised questions or had a simple exchange with the students. Finally for the exhibition of a student, the follow-up questionnaire survey in 12 students in using the knowledge in the exhibition design projects, including the

original author of seven students and project communication for more information, the seven students in the three "one-way information retrieval" is used to describe their communication, the other four is a "two-way exchange of information". In the author's opinion, in addition to the short exhibition time, complex English test and other objective conditions, the participation of sustainable followers and the enthusiasm of feedback are related to the degree of system openness. In the limited open Windows of the system, effective information communication and feedback support services are also important. In the follow-up questionnaires and interviews of students from other schools who attended the exhibition, the research subjects proposed Suggestions such as "establishing a knowledge platform" and "providing a table summary of all the involved points". Therefore, in the design of knowledge service system, it can be considered to further expand the openness of the system, such as opening part of the teaching activities and establishing a knowledge exchange platform. It also provides support services for effective feedback.

In the knowledge exchange between the system and the outside world, there exist the problems of the complexity and specialty of the input knowledge. Through questionnaires and interviews with students, the author learned that students spent a lot of time searching and sorting out materials in order to complete the research project. And part of the data major over high, students can not understand and use. Part of this has to do with the setting of the assignment requirements, and part has to do with the lack of a reliable and accessible source of knowledge for design students. Therefore, while improving the research quality of students majoring in design, we should also provide them with information, data and tool platform friendly to non-professionals.

At the output end of the system, the knowledge flow is limited. At present, the system mainly realizes knowledge output to the outside

world through public exhibition and WeChat public platform. The output is mainly about the achievements of excellent student research projects. Among them, the exhibition of teaching results after the end of the course has been a tradition, while the sharing of knowledge with the help of network social platforms has been an attempt in the past two years. Through and maintains WeChat platform of student teaching assistant interview the author understands, start from the fall of 2017 program, part of the excellent student research projects after finishing editing and student teaching assistant in terms of "bionics" sustainable design laboratory WeChat public platform, in the form of illustrated at the end of the course of the frequency of the spring semester to about two week to push on a regular basis. Currently, the fall 2018 program is being organized and launched. From April 2018 to May 2019, 29 student research projects (14 courses in 2017 and 15 courses in 2018) have been promoted, with a cumulative reading volume of 6,395 people, with an average reading volume of 220 people per article. During this period, more than 500 new followers have been added to the WeChat public platform.

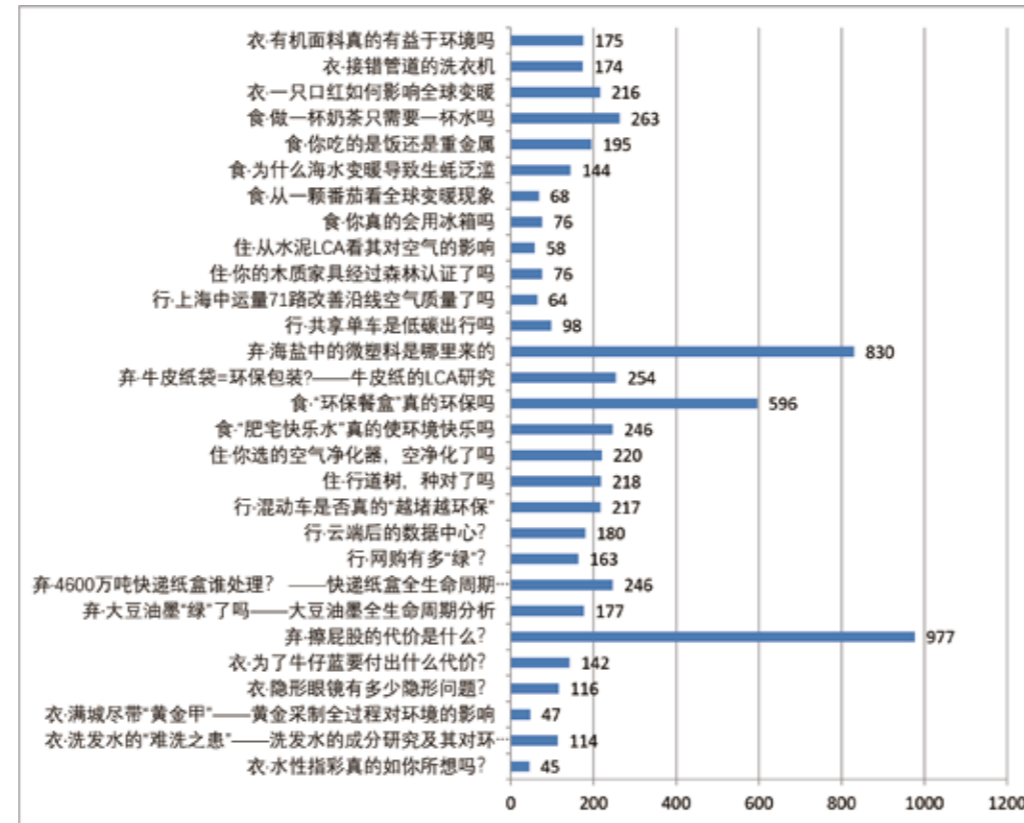
It can be seen that the model of exporting knowledge products produced by courses to the outside world through online social platforms has a significant effect on expanding influence and attracting potential sustainable followers. However, we cannot evaluate the external absorption and utilization efficiency of the output knowledge products, and the actual value of the knowledge products is not reflected. Therefore, in the subsequent design, on the one hand, we can continue to make use of the existing WeChat public platform as a channel and the accumulated platform followers as a user base to output more abundant and diverse knowledge products produced in the course to the outside world. On the other hand, other channels can be expanded to reach more different types of people.

B Case Analysis

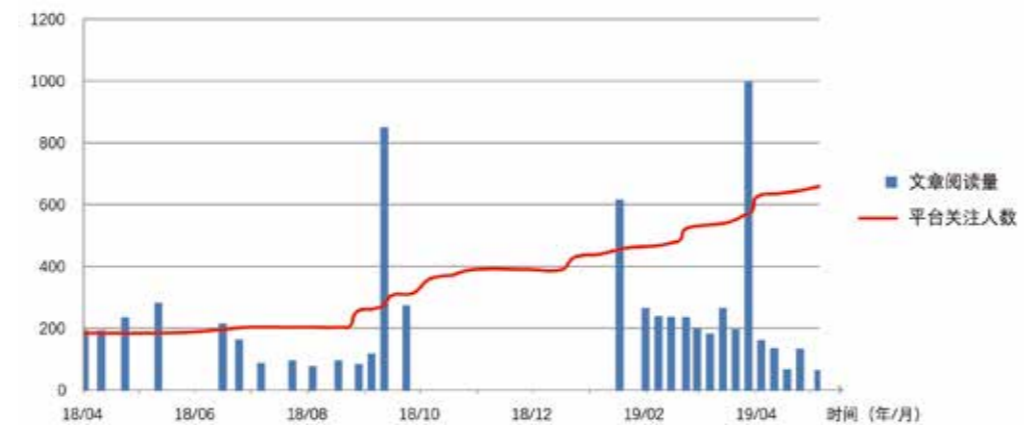
Stakeholders and Service Ecology Research

Furthermore, the contents and forms of knowledge products exported to the outside world are also worth in-depth discussion and design. Ezio Manzini (2016) points out that the design education process needs to improve the ability of design students to conceive and develop design solutions (from the overall vision to specific solutions) in order to design for a better world. If most of the projects are simply considered teaching exercises, which end up in the teacher's file cabinets and computer folders, there will be a lot of unused design work, which is actually a waste of creativity, enthusiasm, and expertise on the part of students and teachers. In the past, such waste might have been considered inevitable. Now, when we are in the midst of a transition to sustainable process, there are a lot of demand for vision and solution, at the same time, considering the various alterations in the design process itself, all this waste should be avoided: design results and the ability of students must become more social value, and provides solutions to the current complicated social problems.

At present, the output of "Sustainability Design Consciousness" course is mainly based on research results, and does not advance to a specific solution. Therefore, in the process of output, it is mainly based on the popularization of knowledge, and it cannot be directly applied to produce social value. Therefore, the design of knowledge product service system can be adjusted from the setting of students' homework to balance the proportion of research and design. But considering the objective and class limitation, the author thinks that is a more feasible strategy, the concept of "sustainable design" course and design professional class or graduation design project of cooperation, based on the concept of "sustainable design" students study the knowledge of the output products, the design professional course or graduation design in the project design appropriate solutions. Then communicate with the outside world at the level of the solution and explore its practical value.



WeChat platform students research project push the article reading amount (data source: BiDL bionics sustainable design laboratory WeChat public platform)



WeChat platform followers growth (data source: BiDL bionics sustainable design laboratory WeChat public platform)

B Case Analysis

Stakeholders and Service Ecology Research

Summary

ANALYSIS ★ STRENGTHS ! WEAKNESS 💡 OPPORTUNITIES KEY POINTS

Stakeholders

A certain number of participants with different functions have been brought together. ★

B1 Enhance **the diversity of participants**, enrich the source of knowledge and promote knowledge flow.

Service Ecology System

Low involvement of sustainable followers. !

B2 Further **expand the openness of the system** and provide corresponding support services for **effective feedback**.

Complexity of resource as system input. !

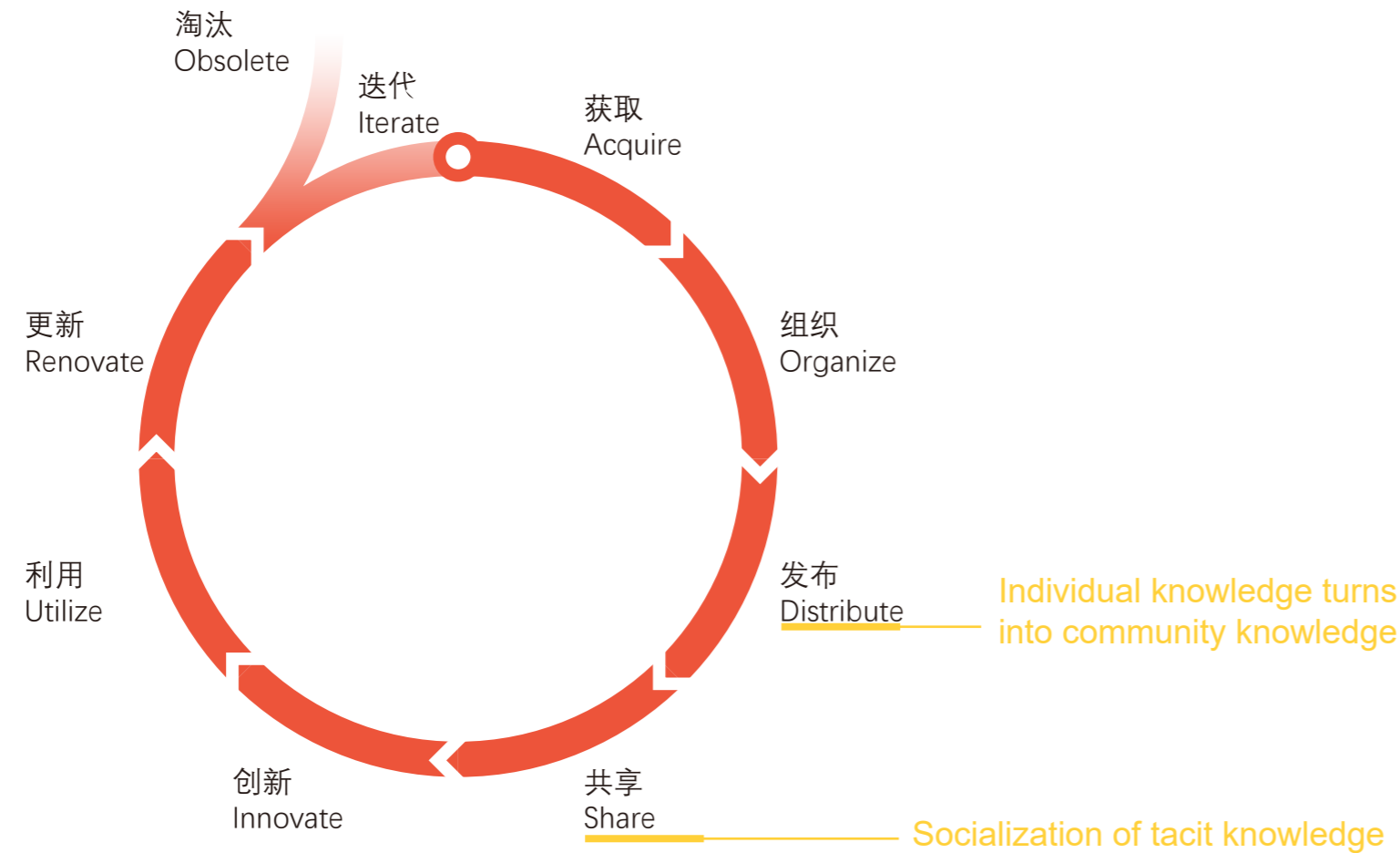
B3 Improve student **research literacy** and provide a non-professional friendly **information and tools platform**.

Limited amount of knowledge flow as system output, among which WeChat platform has the best effect. ★

B4 Use the **WeChat public platform** to export richer results to the outside world and **expand other channels**.

The output of the system is mainly based on the research results of the students' projects, and has not been advanced to a specific solution. !

B5 **Connect with design studios or graduation design projects**, work together to design corresponding solutions. Communicate with the outside world at the program level and explore the practical value of students' work.



Knowledge Life Cycle

Source: MCELROY M. The new knowledge management: Complexity, learning, and sustainable innovation [M]. Butterworth-Heinemann, 2002.

Knowledge Life Cycle

Life cycle refers to the birth, aging, illness and death of an object. This concept is widely used in the fields of politics, economy, environment, technology and society. When we apply it to knowledge management, we have the concept of "knowledge life cycle". It was first proposed by Mark w. McElroy, an American knowledge management consultant, in his book new knowledge management: complexity, learning, and sustainable innovation. McElroy believes that knowledge is generated in the human social system and acquired through sharing among individuals, and calls this process of knowledge sharing at the organizational level "knowledge life cycle" (2002). This definition has certain limitations, because the author mainly discusses the sharing of knowledge from the perspective of enterprise knowledge management, and does not explain the flow process of knowledge (Liu Yiming, Yang Min, 2018). Therefore, there are many different views on the specific meaning and stage division of knowledge life cycle.

Considering the enterprise knowledge management and knowledge service teaching activities in the differences of knowledge flow process, the author will teaching situation in the process of knowledge service knowledge life cycle is defined as the service participants to acquire knowledge from teaching activities or other subject, absorbed through internalization and externalization share or applications, and to get feedback in practice process, and can be divided into acquisition, organization, publish, share, innovation, use and update the seven stages.

Knowledge Acquire: it mainly refers to the process in which students Acquire Knowledge from teachers and relevant teaching resources through classroom teaching, lectures, visits and reading, or through experiments, observations, summaries, analyses and thinking. In

addition, knowledge acquisition also takes place in the process of communicating, discussing and cooperating with others.

Knowledge Organize: Knowledge organization is a process in which students complete the construction of Knowledge, including students internalizing and absorbing Knowledge after acquiring Knowledge, i.e. implicit explicit Knowledge, and completing related assignments, exercises or projects to express and apply the Knowledge they have mastered, i.e. externalization of tacit Knowledge. At the same time, through the conscious collation, that is, the combination of explicit knowledge, to achieve the ordering of knowledge, the formation of learning community knowledge base.

Knowledge Distribute: the process of releasing Knowledge organized by students in the form of public report or exhibition for members of the learning community to browse or take advantage of. This is the process of transforming individual knowledge into community knowledge through externalization.

Knowledge Share: Knowledge is transferred among community members through Shared activities such as dissemination, communication and discussion, and new Knowledge exchange and feedback are triggered. This is the process of tacit knowledge socialization.

Knowledge Innovate: a process in which students improve and Innovate Knowledge on the original basis by combining the results of Knowledge exchange among community members.

Knowledge Utilize: applying Knowledge to practice, and the process of creating value.

Knowledge Renovate: the process by which students update their

Knowledge based on feedback from experience in practice.

In addition, the author believes that from the perspective of service system sustainability, the life cycle of knowledge has many forms of cyclic iteration. Through the updating of knowledge, valuable knowledge will go into the next cycle, be acquired again, and be developed through continuous iteration. Knowledge that has lost its value will become redundant, naturally sink or be destroyed.

Knowledge Service Mode Of Teaching Activities

According to the different stages of the knowledge life cycle covered by the knowledge service of teaching activities, the author divides the mode of knowledge service into five types, and gives an example of the common mode of knowledge service in higher education:

The first level of knowledge services involves only the acquisition of knowledge. For example, teachers transmit knowledge to students through one-way knowledge output. Generally, large-class teaching or independent lectures with a large number of students belong to this kind of knowledge service mode, and further knowledge organization and communication cannot be carried out due to the practical conditions.

The second level of knowledge services includes the acquisition and organization of knowledge. For example, students acquire knowledge through classroom teaching and organize knowledge by completing corresponding exercises. However, the knowledge handed in by the organization is not publicly released and therefore cannot be Shared by community members. Usually the basic theory or technical courses belong to this kind of knowledge service, which only emphasizes the individual's understanding and mastery of the theory or technology, but omits the knowledge release and the subsequent process.

The third level of knowledge services covers the process of acquiring, organizing, publishing, and sharing knowledge. Knowledge is published and Shared mainly through group discussion, public report and question-and-answer, exhibition and feedback collection to realize knowledge exchange with other members of the learning community. This type of knowledge service usually appears in long-cycle research or practical courses that require teamwork, and is the mainstream teaching form of design education at present.

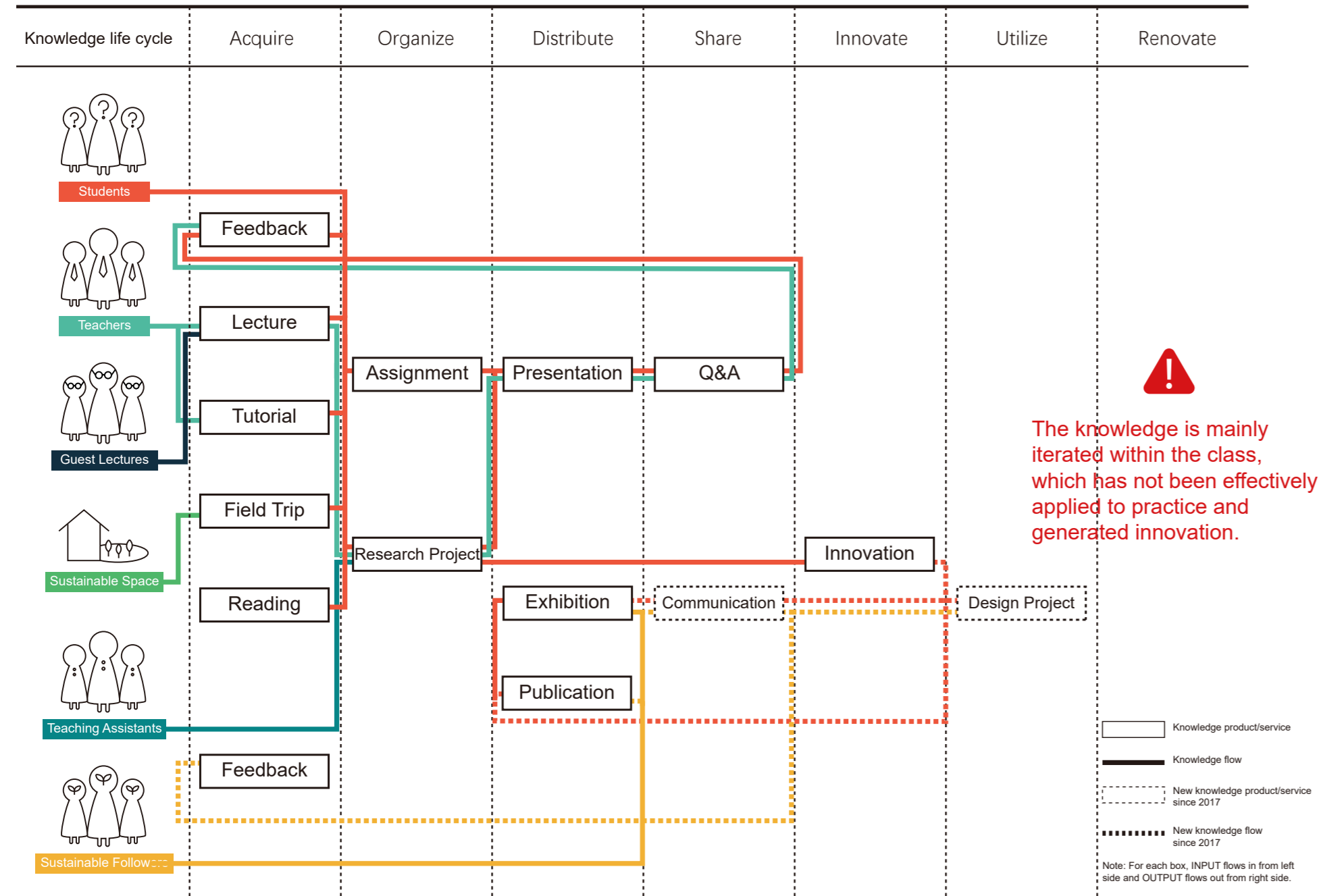
The fourth level of knowledge service increases the innovation of knowledge on the basis of the previous level. Get feedback from community members' interactions and innovate knowledge. And through the knowledge spiral, the knowledge that belongs to the individual becomes the knowledge of the community. This type of knowledge service emphasizes collaboration and mutual learning among community members. Such as seminars, debates and other activities are conducive to knowledge innovation.

The fifth level of knowledge service mode is the improvement of the previous level, which includes the utilization and update of knowledge. It emphasizes the realization of the value of knowledge in the application of knowledge. And through the real feedback generated in the process of practice to update knowledge, through the re-creation of knowledge, improve the value of knowledge. In the teaching and research activities of science and engineering majors, students can make use of the knowledge through experiments and update the knowledge based on the experimental results. In design education, students can use what they have learned through design projects to update their knowledge based on design results and user feedback. However, in general, due to the limitations of technology or resources, the use of knowledge is seldom involved in teaching activities. Only when students carry out work related to their major can they have the opportunity to make use

of the knowledge they have learned to carry out application and update their knowledge in practice. As a relatively complete knowledge service pattern, this kind of knowledge service pattern is less realized at present, which will be the direction of knowledge service perfection.

It is helpful to define the stages of knowledge lifecycle in the context of this paper to build an effective knowledge service framework model based on life cycle. By analyzing the different stages of the knowledge life cycle in teaching activities, the behavioral activities of service participants and the knowledge flow, the research perspective and analysis framework of the effective combination of the journey of knowledge service users and the knowledge life cycle can be realized. Then from the perspective of system innovation, optimize the user experience, promote the improvement and transformation of consciousness, at the same time to maximize the life cycle of knowledge, extend the life cycle of knowledge, improve the use efficiency and value of knowledge products.

C Case Analysis
User Journey Research Based on Knowledge Life Cycle



C Case Analysis
User Journey Research Based on Knowledge Life Cycle

The user journey map is used to describe the user's journey through the service as a series of different contacts representing the interaction between the user and the service. Each stakeholder of the knowledge product service system realizes the processes of knowledge acquisition, organization, release and sharing by participating in different knowledge product services, i.e. interacting with the services. Based on the overall observation of the teaching activities, the author analyzes the behavior and knowledge flow of service participants in each stage of the knowledge life cycle.

In the stage of knowledge acquisition, students achieve the initial acquisition of knowledge through the knowledge services such as lectures, counseling, field trips and reading in the knowledge product service system. The knowledge input of lectures mainly comes from teachers and guest guests, the knowledge input of tutorial mainly comes from teachers, and the knowledge input of field visits mainly comes from the sustainable practice base. No participants were involved in the knowledge input of the reading. In addition, students can use other knowledge services outside the curriculum system to acquire knowledge related to sustainability, such as libraries or the Internet, but these knowledge services are not considered for the time being.

In the knowledge organization stage, students combine the knowledge acquired in the previous stage with personal or group investigation and research in real life or in the network to form the knowledge product of classroom exercises and research projects. Teachers will continue to provide knowledge input in the organization of research projects. Since the period of in-class practice is short, only one week, teachers seldom intervene in the process of knowledge organization of students' in-class practice.

In the knowledge release stage, some excellent assignments in the last

week will be reported and released before class, and research projects will be reported twice in the mid-term topic selection and the final period. This is the first release of knowledge products, and the main audience is students and teachers in the course. Among them, although the final report is public report, but the actual attendance of the extracurricular audience is very few.

In the stage of knowledge sharing, teachers and students ask questions about the knowledge products formed by students. In the process of communication, there will be two-way knowledge flow between the two sides. In addition, other students listening to the presentation can also gain knowledge from the sharing of the presenter, so as to realize the transfer of knowledge among community members, and trigger new knowledge exchange and feedback through informal communication and discussion among students.

In the knowledge innovation stage, students will innovate the research project by combining the new knowledge acquired the second time from the feedback of others in the knowledge sharing stage. This feedback-innovation loop iterates three or four times in the actual course, with the teacher making suggestions and the student making modifications. After many processing and finishing, the teaching assistant will publish the excellent research projects through the exhibition and WeChat platform for the second time. Sustainable followers gain knowledge and generate feedback.

Combining the knowledge life cycle with the multi-user journey map to draw the following chart to integrate the behavior and knowledge flow of service participants in each stage of the knowledge life cycle. The rectangle represents a knowledge product or service. The different colored lines represent the flow of different participants, which is input from the left end of the rectangle and output from the right end.

As can be seen from the above figure, the knowledge life cycle of the course mainly covers five stages of acquisition, organization, publication, sharing and innovation, but does not involve the utilization and update of knowledge. The iterative innovation of knowledge mainly occurs in the process of the development of research projects by students and teachers. Knowledge received little feedback after the exhibition and social platform release, failing to achieve knowledge sharing. Therefore, the knowledge product service system can be designed from the perspective of extending the life cycle of knowledge and promoting the iteration and innovation of knowledge.

At the end of the course in the fall semester of 2018, the author conducted a study on an initiative of innovation and utilization of knowledge based on this course. The background of this activity is that the students of environmental art class B in the second year of the undergraduate program of school of fine arts of Shanghai university came to visit the teaching achievements exhibition in the fall semester of 2108 under the guidance of teacher He Sheng. The main purpose is to learn the research and analysis methods and sustainable knowledge of students' research project in the course and choose a research project to try to apply it in the design project of the course of "architectural principles". During the exhibition, the authors of the student research project explained their group's project to the audience in person and conducted a brief question-and-answer session. Part of the audience and the author added WeChat to each other to facilitate further communication. Two months after the visit, the five-week "principles of architecture" course concludes. The author was invited to participate in the course report and observed the students' design results, and distributed questionnaires. In terms of the utilization of knowledge, 12 out of the 17 respondents used the knowledge gained from the exhibition in their own design projects.

From the perspective of students' design projects, for example, the design scheme of "streamline restaurant" of the research project of "takeout kitchen waste disposal" takes into account the whole closed treatment of kitchen waste and feeds the processed kitchen waste to fish. Using the design scheme of "street reconstruction" of the research project of "research on the ecological effect and optimization scheme of road trees", the construction technology of greening coexistence is put forward, and different climbing supports are designed according to different plant characteristics. Another student team integrated several research projects and proposed the use of solar panels and rainwater collection in the roof garden design of "community activity center". In the author's opinion, these sustainable designs make use of some students' research project knowledge, which is a good attempt for second-year undergraduate design students. However, the method of utilization is relatively simple, which is almost directly superimposed on the original design and fails to be systematically integrated and applied. This is related to the objective reasons such as the shortage of class hours, the different teaching objectives of the two courses, and the sustainable consciousness foundation of the knowledge utilization. In fact, this also reflects the common problem of sustainable knowledge utilization in the design of most students. They think that planting green plants, opening skylights and using solar power generation are sustainable, but they do not consider the environmental impact of design measures in the whole life cycle or seek better solutions from the perspective of system.

Therefore, in the stage of knowledge utilization and updating, while creating more opportunities for knowledge utilization, it is also necessary to build a foundation of sustainable awareness for knowledge users, and to build a bridge between knowledge producers and users on an equal and two-way basis to promote knowledge. The updates applied in practice can efficiently enter the next cycle of knowledge life cycle.

Summary

ANALYSIS ★ STRENGTHS ! WEAKNESS

OPPORTUNITIES KEY POINTS

Knowledge Life Cycle

The course only covers the first five stages of the knowledge life cycle and has not yet involved the utilization and updating of knowledge. !

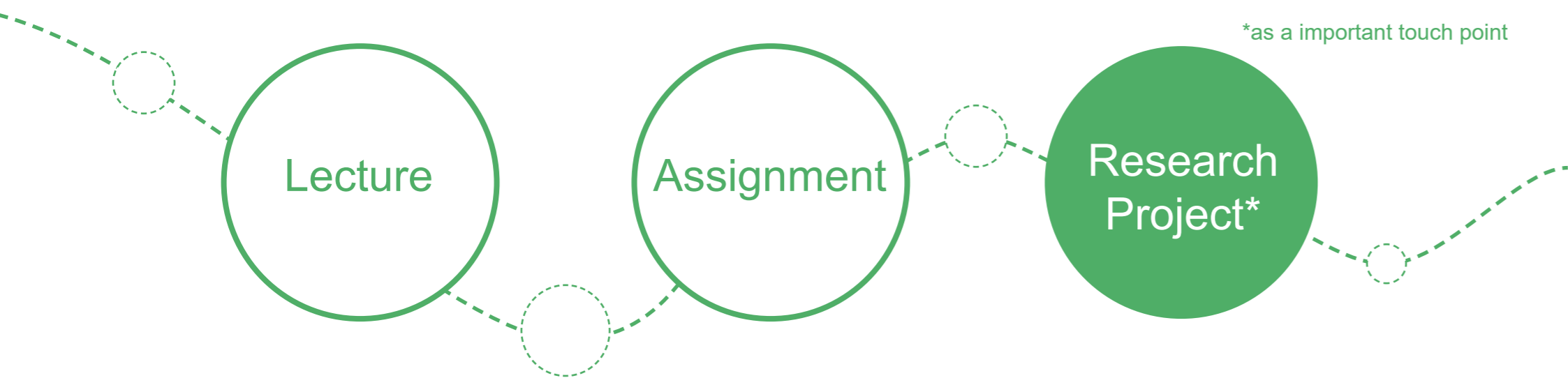
C1 Extend the life cycle of knowledge and promote knowledge **iteration and innovation**.

Knowledge Utilize

In the prototype, knowledge receivers failed to systematically integrate and utilize knowledge products. !

C2 Establish a **bridge between knowledge producers and users**, and promote knowledge to **apply into practice** and enter the next cycle.

Services is a journey or a cycle—a series of critical encounters that take place over time.



Service Touch Points

Service touch points are the visible and perceived parts of a service, and a series of service touch points constitute the user's complete experience of using a service. Service touch points come in a variety of forms, including advertising, web pages, mobile app interfaces, receipts, retail stores, and customer representatives. Service touch points are often the talk of the interaction design world. In the field of marketing, it is called a "service" (service evidences) evidence. In academic research, the more commonly used concept is service encounter, which is the "moment of truth" during the interaction between users and the service system in the service context, and is the direct source of influencing users' service perception. Thus, services can be understood as a series of journeys or cycles of service touch points that occur over time (Parker & Heapy, 2006). Service design is the design of user experience that occurs over time through many different service touch points (Livework Studio Ltd).

Service Touch Point and User Experience Research

There are many different forms of service touch points in the user journey based on the knowledge life cycle described earlier. Through the research and analysis of a series of service touch points, we can understand the users (mainly students), experience and knowledge construction mode in the user's journey, and dig out the pain points, so as to find the design opportunity.

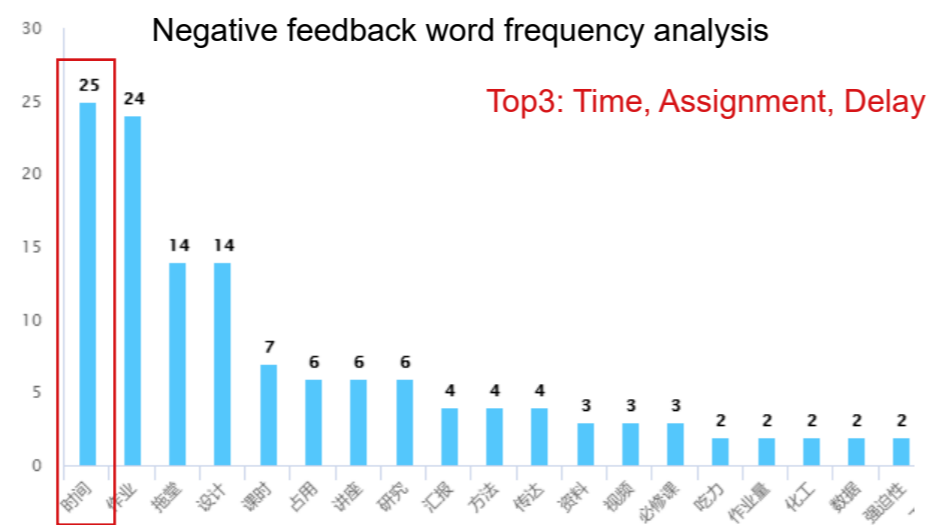
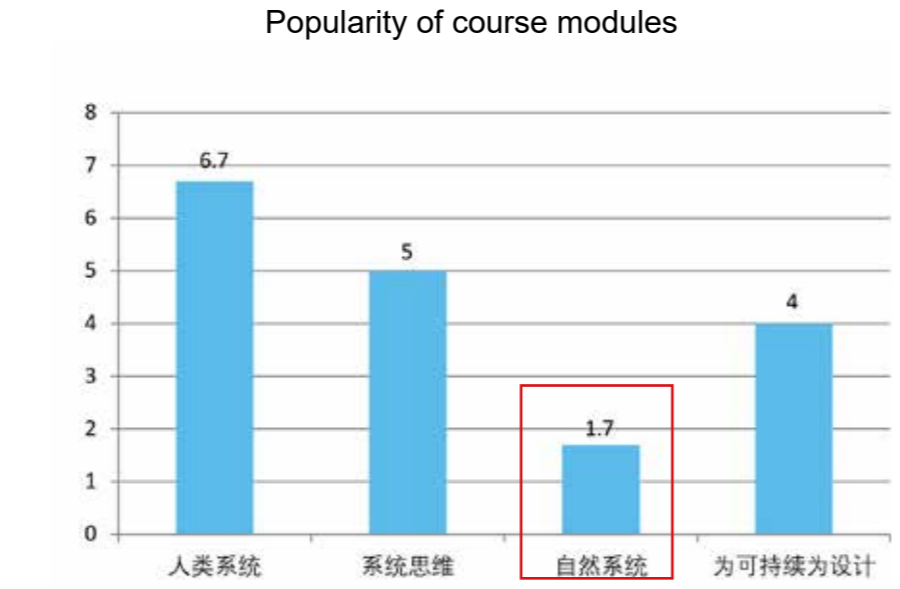
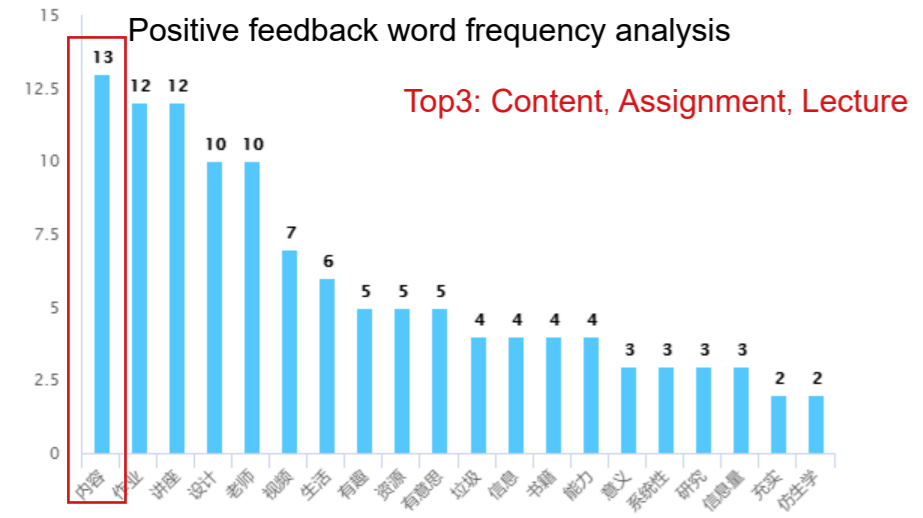
For this reason, within one week after the course report of the fall semester of 2018, the author distributed the student feedback questionnaire of Sustainability Design Consciousness course for undergraduate students in the fall semester of 2018-2019 to 92 students attending the course, and received a total of 60 valid responses. The questionnaire mainly investigates students' learning experience from the

aspects of lectures, classroom exercises, student research projects, field trips and book reading. Next, the author will analyze the questionnaire results, and combine the author's observation and interviews with some students to explore the students' experience in the service process.

According to questionnaires and interviews, students generally believe that the content of the lectures is comprehensive and rich, but factors such as the fast pace of the lectures have affected the course experience. Compared with other lessons, natural system lessons are the most boring.

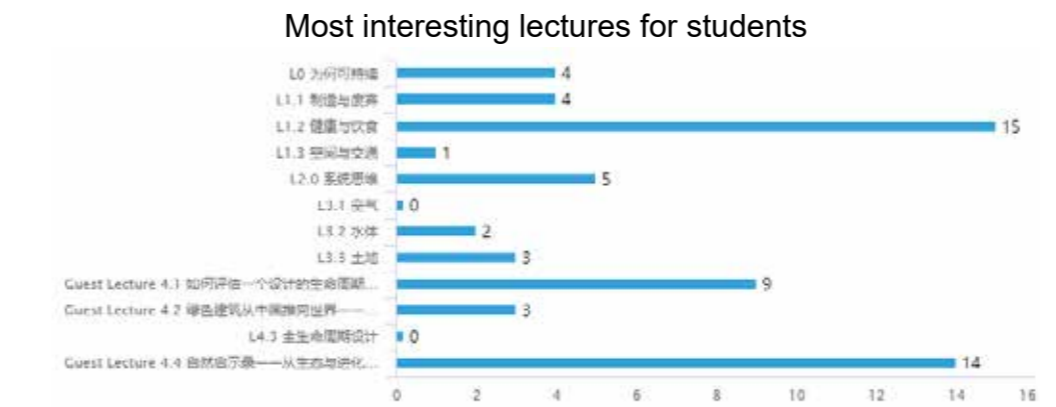


Guest Lecture: Inspiration from Nature (Prof. Guo Guangpu)



Lecture is the most important service touch point in the process of knowledge service. Teachers or guest speakers combine slides, videos, pictures, blackboard writing and other materials and tools to teach students knowledge and skills related to sustainability. This is a process in which the professor or guest transfers the integrated explicit knowledge to the students and the students realize the transformation to tacit knowledge.

The results of the questionnaire show that students generally think the content of the lecture is very comprehensive and rich, which is closely related to life and attractive. The quality of the speeches delivered by the guest speakers was high, interesting and easy to absorb. Of the 12 lectures in the fall semester of 2018 (including 9 lecturers and 3 guest speakers), students were most interested in "food and health" in the human systems module and the guest lecture "natural apocalypse -- design from an ecological and evolutionary perspective" in the design for sustainability module. Some students mentioned that "when Guo Guangpu gave a lecture, he said that fireflies would be sad, and the beetle spent its whole life climbing to the top of the desert, etc. Such anthropomorphic emotional expressions is more likely to arouse people's resonance and help parents maintain their attention for a long time."

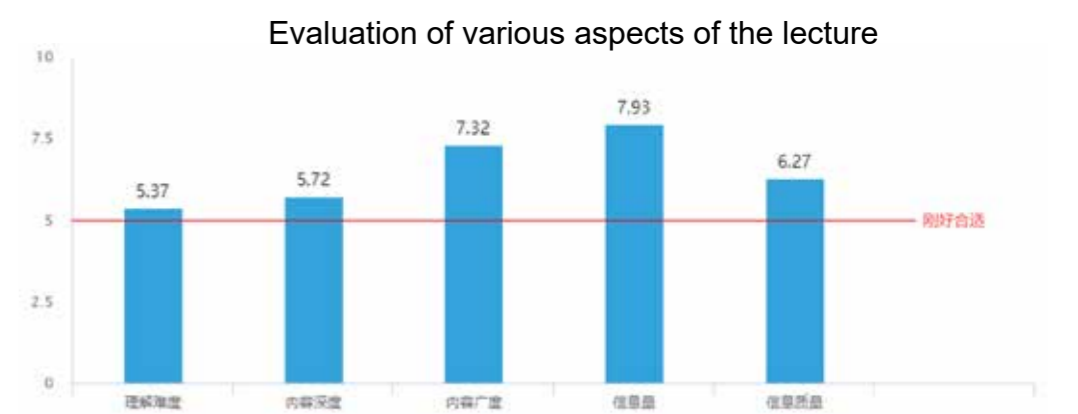


From the perspective of course modules, except for the first introduction course (L0 Why Sustainability), the average popularity score of the four modules is human systems (L1.1, L1.2, L1.3) : systems thinking (L2.0) : natural systems (L3.1, L3.2, L3.3) : design for Sustainability (L4.1, L4.2, L4.3, L4.4) = 6.7:5:1.7:4.

In the word frequency analysis of the positive feedback to the course, the content and lecture (in the context of the answer paper mainly refers to the lecture given by the guest speaker) are mentioned frequently.

Thus it can be seen that the lecture contents close to life and vivid and interesting expressions can bring students a better learning experience. In particular, the lectures on natural system modules that students are least interested in at present can be adjusted to make them more interesting and easy to understand and absorb.

In the evaluation of the lecture, students generally believe that the difficulty of understanding, the depth of content, the breadth of content, the amount of information and the quality of information all exceed the just appropriate level, among which the amount of information and the breadth of content exceed the most obvious extent.



In the author's opinion, this is related to the complexity of the sustainable knowledge system itself, as well as the integration and presentation of the lecture contents. Providing high-quality information and a wide range of content helps students to understand the systematicness and relevance of sustainable issues to some extent. However, the control of information quantity in limited class hours will directly affect students' learning experience and knowledge absorption efficiency.

In interviews, many students thought the pace of class was too fast to understand and absorb. You have to teach yourself after class.




In addition, the questionnaire survey shows that in the feedback of the negative experience of the course, the delay in class is the most prominent problem that students report.

Daniel Kahnema (2012), author of "Thinking, Fast and Slow" proposed the famous Peak-end Rule. He found that people's memory of experience is determined by two core factors: the highest or lowest emotional point, namely the Peak, and the feeling at the End, namely the final value. The evaluation of an event or product is basically based on the peak and final value. For example, the sample room experience is the peak experience design of IKEA, and the final value is the one dollar ice cream at the exit. Therefore, the experience at the end of the lecture is a final value. Therefore, the negative emotions caused by the delay will affect the students' experience evaluation of the whole class.

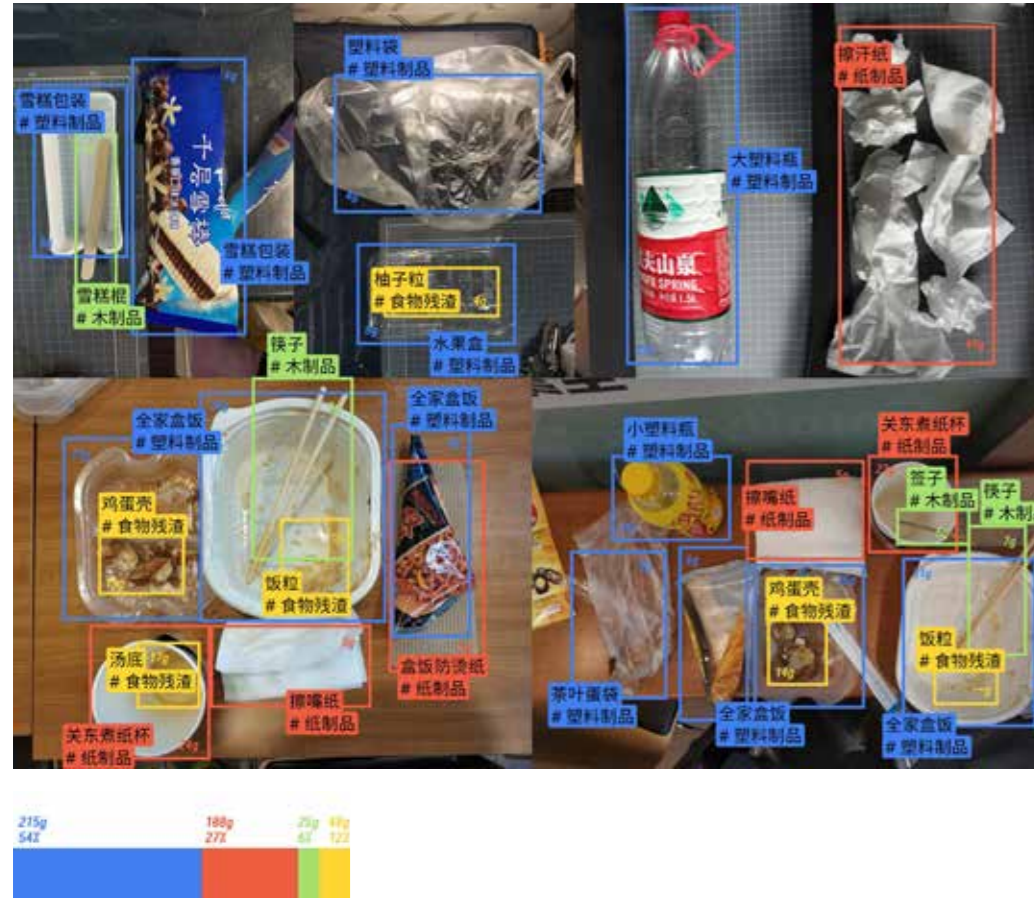
Therefore, under the condition that the class schedule remains unchanged, the information in a single lecture can be appropriately reduced, or a part of the information can be transmitted to students in a more efficient way, such as students' lectures, seminars, self-study, etc., in order to control the class time and leave the opportunity for students to digest and absorb by themselves. In addition, some fun and easy content can be put before the end of the course to ensure that students

have a good end-value experience.

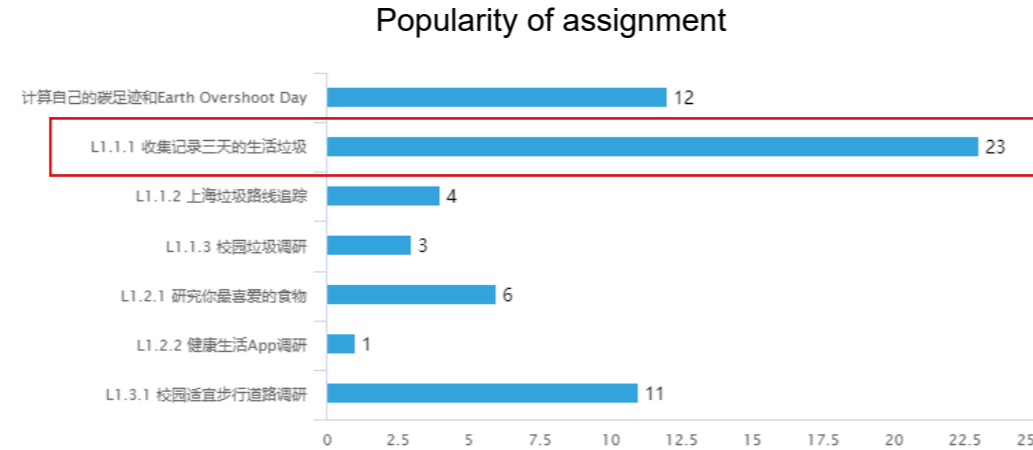
Summary

 ANALYSIS <small>★ STRENGTHS</small> <small>! WEAKNESS</small>	 NEEDS	 OPPORTUNITIES <small>KEY POINTS</small>
<p>Content</p> <p>The content of the lecture is comprehensive, and it is attractive because of closing to life. Guest lectures are of high quality, interesting and easy to understand. <small>★</small></p> <p>The least interesting for students is lectures on natural system modules. <small>!</small></p>	<p>Close-to-life lectures content together with lively and interesting expressions.</p>	<p>D1 Adjust the content and form of the lecture to make it more interesting and understandable.</p>
<p>Form</p> <p>The information provided in the lectures was too much to be absorbed, which also caused serious delays. <small>!</small></p>	<p>Slow down and control time.</p>	<p>D2 Reduce the amount of information in a single lecture or convey some of the information in a more efficient way.</p> <p>D3 Put some easy and interesting content before the end of the course to ensure a good ending experience.</p>

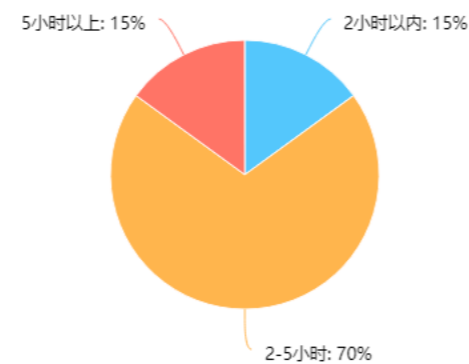
Through questionnaires and interviews, we can see that close-to-life observation, field visits and active investigations bring personal experience that has a great impact on students' lifestyles and sustainable consciousness.



Most popular assignment: Collect and record domestic garbage for three days
(Source: Yang Guanghe)



Average time spent on assignment every week



Assignment is a small research project on field research, case analysis and other small-scale research related to the content of three lessons of the human system module. It is completed by a student or a group of two to three people within one week and handed in before next class. The assistant helps the teacher choose three to four assignments, and the corresponding authors will make a brief presentation before the class. This is the process by which students transform part of the tacit knowledge accumulated in the class and life into explicit knowledge, by organization and expression.

In the assignments, the students were most impressed by "collecting and recording household garbage for three days". The exercise requires students to collect all their own trash within 72 hours. Before 2018, the presentation form after one week is to ask students to bring their own garbage to the classroom, intuitively showing the huge consumption and pollution caused by daily life. Considering the large number of people attending the course in 2018, the exhibition form was changed to photo recording analysis and electronic document display. The students said they had never realized how much household waste they produced.

In the word frequency analysis of both positive and negative feedback to the course (see previous page), the assignments (which in the context of the answer paper mainly refer to assignments) were mentioned very frequently. Explain that students have a love-hate attitude towards the classroom practice. According to the feedback of students, the positive reason is that the personal experience brought by the observation records close to life, field visit and active research has a great impact on the students' lifestyle and the concept of sustainability. The negative reason is that the assignment takes a long time, and too much emphasis is placed on the plane expression. In many cases, the organization of efficient communication takes more time than the collection, screening and sorting of information. Statistics show that most students put in an

average of two to five hours a week to complete the assignments.

In the author's opinion, we should keep the current practice related to life in class, and even extend it to the natural system module, and try to implement the corresponding small practice related to life in water, air and land. It also encourages a variety of presentations to reduce time students spend editing electronic documents. For the assignments that need to form electronic documents, a simple template can be developed, which is convenient for students to organize and present on the basis of the template, and also for the subsequent integration and application.

According to the theory of knowledge construction mentioned above, the assignment, as a conceptual product of students' collaboration, can be developed into an important resource in the learning community through the release and sharing of knowledge. It is understood that one of the current delivery methods for assignments is to be uploaded by students to the Teambition online platform. The platform allows you to view documents submitted by others and leave comments for discussion online. At present, although some students will check others' works, there is no communication function of students using the online platform. Another release form of assignment is in-class report. According to the author's observation, in-class report before class is a good form of communication. The author can explain the main results of the study by combining the projection of electronic documents, and the teacher can give a brief evaluation. However, due to the time limit of the course, the reporting group was very limited, and the students did not have the opportunity to have further discussions.

Therefore, the communication function of the Teambition online platform can be fully utilized to encourage students to browse other people's assignments and discuss. Teachers and teaching assistants can also join in, providing feedback or asking questions to spark a conversation.

D Case Analysis
Service Touch Point : Assignment

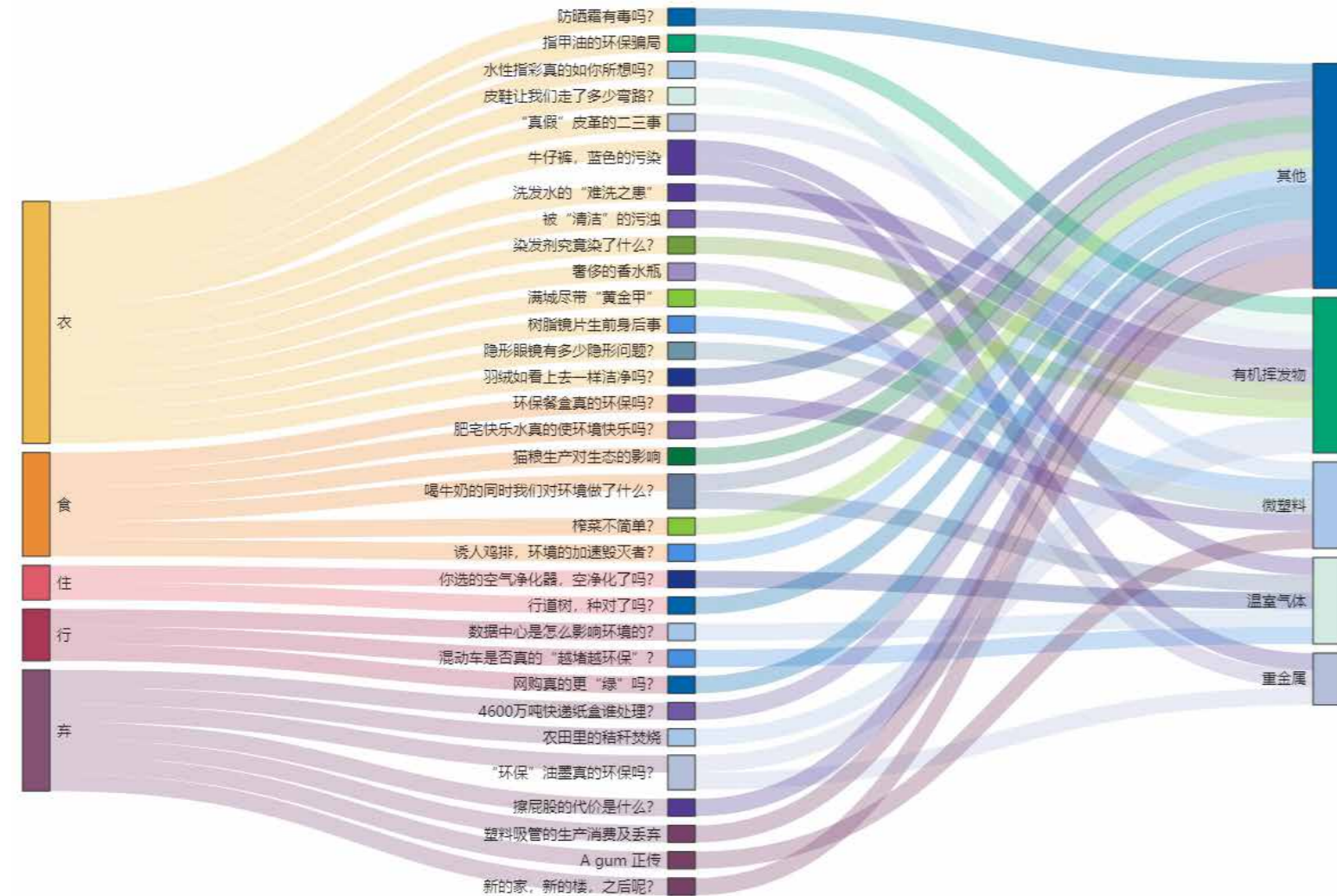
Or encourage students to spontaneously organize seminars offline to transfer knowledge among community members through exchange and discussion, and trigger new knowledge exchange and feedback.

D Case Analysis
Service Touch Point : Assignment

Summary		
ANALYSIS	NEEDS	OPPORTUNITIES
<p>★ STRENGTHS ! WEAKNESS</p>		KEY POINTS
<p>Content</p> <p>Close-to-life research has a great impact on students' lifestyles and sustainability concepts. ★</p>		<p>D4 Keep current assignments for Human System module and expand to the Natural System module.</p>
<p>Form</p> <p>Time consuming and emphasising to much on graphic design. !</p>		<p>D5 Encourage diversified presentations in addition to electronic documents or develop templates for electronic documents.</p>
<p>Disturibute and share</p> <p>Sumbit online to Teambition, some good works will be selected and present in class. !</p>	<p>Some students will check others' work on Teambition, but won't leave comments or use the communication function. ★</p> <p>Limited time for presentation and students have no time to discuss. !</p>	<p>D6 Encourage browsing and discussions with the Teambition communication feature. Encourage students to organize seminars online/offline and to realize the transfer of knowledge among community members and trigger new knowledge exchange and feedback.</p>

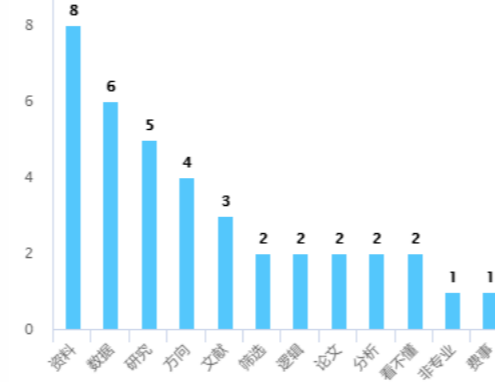
Through questionnaires and interviews and analysis, we can see that there are multiple correlations between research topics, where lies the possibility of different forms of collaboration. The collection of data is a difficult part of the research process.

Multiple correlations between research topics



Difficulty in research process

Top3:Resourse, Data, Research



Final presentation

The research project starts in the third week of the course, and the students form a team of three to choose their own topics in a given range. It takes about six weeks to complete. The research topic comes from the aspects of daily life such as clothing, food, places, mobility and waste. Students will choose a specific object, material or behavior in one of the aspects to study the impact of human behavior on the environment. The focus is on the air, water and land in the natural environment system. On this basis, potential design intervention directions or strategies are further explored to repair or regenerate the damaged environment, i.e. to achieve positive environmental impact. In the process of development of research projects, there exists a process of mutual flow and transformation of explicit knowledge and tacit knowledge, such as individual research, group discussion, teacher-student communication, report presentation, etc., and it is a kind of continuous and in-depth exploration activity aiming at specific problems.

From the perspective of organizational form, the group cooperation mode of the research project in the fall semester of 2018 is to select the same research object for the three-person group, but explore the impact of the object on the natural environment in the whole life cycle from three aspects: air, water and land. This is different from previous years when research projects were completed as individuals. The previous requirement was for each person to choose an object and study its environmental impact on one of three aspects: the air, the water and the land. With Zhu Xiaocun teacher interviews, the author understands the change of the research project organization set up an objective reason is considering the numerous (92) in 2018, the number of students is almost three times the number of elective courses in before, such as the continuation of individual assignments in the form of a class there will be more than ninety subjects, and the number of selected topic can be in the form of group project control in the 30 or so, maintain the number

of similar to the original. In addition, another subjective reason is to cultivate students' overall consciousness and systematic thinking ability. As mentioned above, this is a knowledge capability closely related to sustainable work and life. In practice, the three members of the team can jointly conduct research on the entire life cycle of the selected objects, analyze the environmental impacts of the three aspects of air, water and land, and jointly explore potential design intervention directions and strategies. The division of labor and cooperation within the group can help students have a comprehensive and in-depth understanding of the research object and put forward a more holistic design thinking. In addition, students who are also studying air, water and land in natural systems can also communicate with team members studying other objects across the group, and compare the ways and degrees of different objects' life cycles affecting the same aspect of natural systems. From the perspective of human system, groups in the five themes of "food, clothing, housing, mobility, waste" can also communicate based on common topic areas. From the perspective of knowledge construction theory, group cooperation based on the two dimensions of natural system and human system provides a foundation for dialogue and collaborative knowledge construction in small-scale learning communities with common topics. However, according to the observation of the author and the feedback from students, the actual situation is that the degree of group cooperation is not very high. In some groups, each member is only responsible for his own part and does not communicate and integrate with other members. In addition, due to various reasons, such as the tight schedule of assignments and large differences in topics, students did not communicate with other team members in the direction of natural system or the direction of human system. Therefore, the author believes that we should make full use of the basis of common topics, promote the communication and cooperation between the members of the group and the cross-group, promote the sharing and

innovation of knowledge, and realize the collaborative construction of knowledge in the community.

Shared by the author and several other student teaching assistants for 2018 fall semester students formed in the course of research projects and its research content, research topic can be found that some of the different final focus on the same kind of marker "environment", namely the object of study mainly through some characteristics of the material impact on the ecological environment. For example, research objects such as nail polish, hair colorants, straw burning, and "environmental friendly" inks all produce Volatile Organic Compounds (VOCs) in their life cycle, resulting in environmental pollution. From this, we can derive another analytical perspective for the research project in addition to natural systems and human systems. "Environmental markers" can be said to be an important node of association and convergence between human system and natural system, which reflects the coupling relationship between human and natural system, and is a relay station for the study of human and natural coupling system.

Based on the results of the questionnaire, it can be found that most students think the final research project is difficult.

However, in the interview, the author learned that the knowledge of such "environmental markers" is exactly what students majoring in design do not know and are good at. In particular, data collection and data processing are the most difficult areas for students.

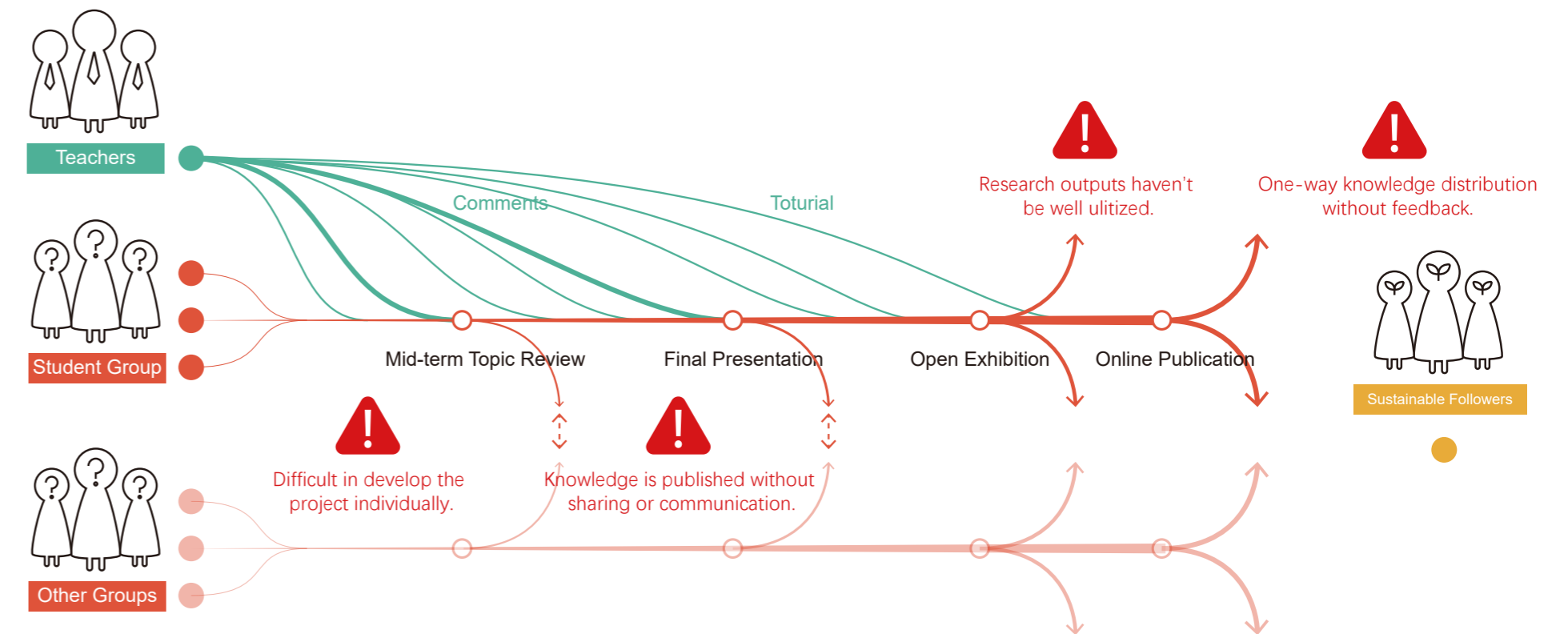
Therefore, consider adding more "environmental markers" to lectures, tutorials, or bibliographies, and providing students with relevant materials and data processing tools and methods during the research process. On the other hand, in terms of setting the requirements of research projects, the requirements of quantitative research can be appropriately relaxed, and students are encouraged to study the connection and influence

between design and environment from a qualitative perspective.

One of the main ways in which research projects are published and Shared is the in-class reporting at the middle and end of the project. Due to the large number of students, during the mid-term report, students need to explain the research object selected by the group and the research direction to be carried out in the form of a group within 1-2 minutes. According to the author's observation, although some groups have had communication and guidance with teachers in the early stage, students are nervous about the mid-term report, which is the first public communication of students' research project topic direction, and they can seldom complete the elaboration within the specified time. In addition, the teacher team will also give a lot of feedback to students. Therefore, the time of the report session will be extended correspondingly, which will cause negative emotions of teachers and students. This problem is more obvious at the end of the report, so we have to use strict control, timeout interruption. However, many students reported in the interview that each group only had four minutes to explain the research results, which was not enough time. In addition, since the time of the report is the morning after the students submit the documents, many students are tired, so they will not appear on the spot to listen to the sharing of other groups when it is not their turn to report, not to mention the questions and exchanges between students. And the final report was originally an open teaching activity, but due to information dissemination and other reasons, only a few extracurricular sustainable followers showed up. In short, due to various reasons, in-class reporting fails to achieve the purpose of knowledge dissemination and sharing.

Another form of publishing and sharing of research projects is an exhibition of teaching results more than a month after the end of the course. The exhibition is designed and organized by student teaching assistants, and the content of the exhibition is further integrated and

Further analysing into the research project process from topic selection to presentation and exhibition, we can find that the research project has problems in collaboration, communication, sharing, and ultizing of research outputs.



innovative student research projects after multiple student-teacher feedback iterations. The exhibition for the fall semester of 2018 will feature student project content printed into a long strip and displayed tiled on the wall. When students from other schools come to visit, some of the student project authors are invited to present and explain their works to the audience. Through the communication with the students and teaching assistants present, the author found that the students could better convey the research results by explaining the integrated and innovative projects on the exhibition site in a relatively free time, so that the audience could better understand them and have a relatively free communication environment.

The research project will also be published through the WeChat public platform mentioned above, so it will not be discussed here.

Therefore, the author believes that it is advisable to consider the appropriate distinction between student project submission and public presentation. In other words, it provides time and space for feedback iterations of knowledge products between students and teachers and for release and sharing in the student community, respectively. To be specific, online or offline, a group of students and a team of teachers can be independently displayed and communicated, so as to realize the knowledge sharing and the joint construction of new knowledge between teachers and students, and complete the iteration and formal submission of research projects. Online communication records can be made public for other students to refer to. A large number of problems in student groups can be solved by making appointments in advance and communicating in batches. And will be arranged on public display in innovation research project iteration is relatively mature, can display and reporting, or in the form of seminars, so that the students can be easy to share, and communicate with other students and sustainable followers discussion, in which teachers and teaching assistants to guide and

assist, promote the sharing of knowledge innovation and collaborative construction.

Summary

ANALYSIS <small>★ STRENGTHS</small> <small>! WEAKNESS</small>	NEEDS	OPPORTUNITIES <small>KEY POINTS</small>
<p>Organization</p> <p>In groups of three, choose topics in "clothing, food, places, mobility, and waste" to study the impact on "air, water, and soil," and study the relationship between the human system and the natural system. <small>★</small></p>	<p>Some groups failed to work as teams and cross-group collaboration hasn't been achieved. <small>!</small></p>	<p>D7 Utilize the common topics to promote the exchange and cooperation of members within and between groups, promote the sharing and innovation of knowledge, and realize the collaborative construction of knowledge in the community.</p>
<p>Research Topic</p> <p>Different research topics are interrelated at the level of "environmental markers". <small>★</small></p>	<p>Most students find the final research project difficult, especially the data collection and data processing. <small>!</small></p>	<p>D8 Provide tool and methods for data processing during the research process. Appropriately remove the requirements for quantitative research and encourage qualitative research.</p>
<p>Disturbute and Share</p> <p>The class presentation is on the next day of submission. Selected projects are polished and published in exhibition and WeChat platform. <small>★</small></p>	<p>The intensive content and limited time for presentation caused overall delay. <small>!</small></p>	<p>D9 Differentiate submission of student research projects and public presentation. Teachers and students have multiple iterations of feedback individually or in groups, and the assignments are submitted in advance</p>
	<p>A few students and sustainable followers attendd the class presentation with little communication. <small>!</small></p> <p>The exhibition has enough time for presentation, with innovative content, leading to good results. <small>★</small></p>	<p>D10 Combine the final exhibition and presentation, focusing on the communication between students and audience (sustainable supporters).</p>

3. Service Strategy

How to improve the existing knowledge product service system with the service innovation approach?

CHAPTER 4

Knowledge Product Service System Analysis
on Sustainability Design Consciousness Course

Knowledge Transformation and
Collaborative Construction Analysis

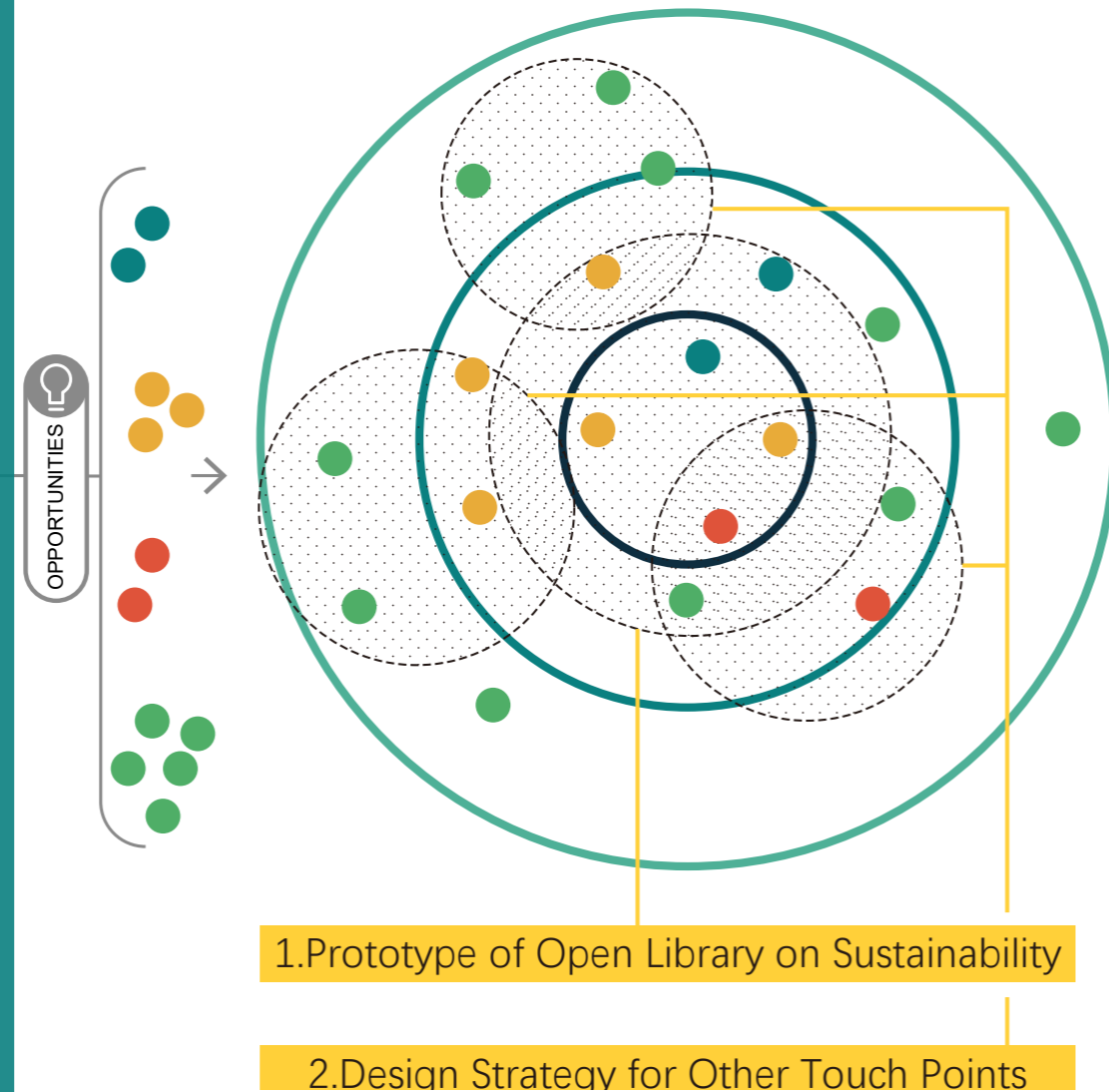
Stakeholders and Service Ecology Analysis

User Journey Analysis Based on
User Experience Analysis

Service Touch Points and
User Experience Analysis

CHAPTER 5

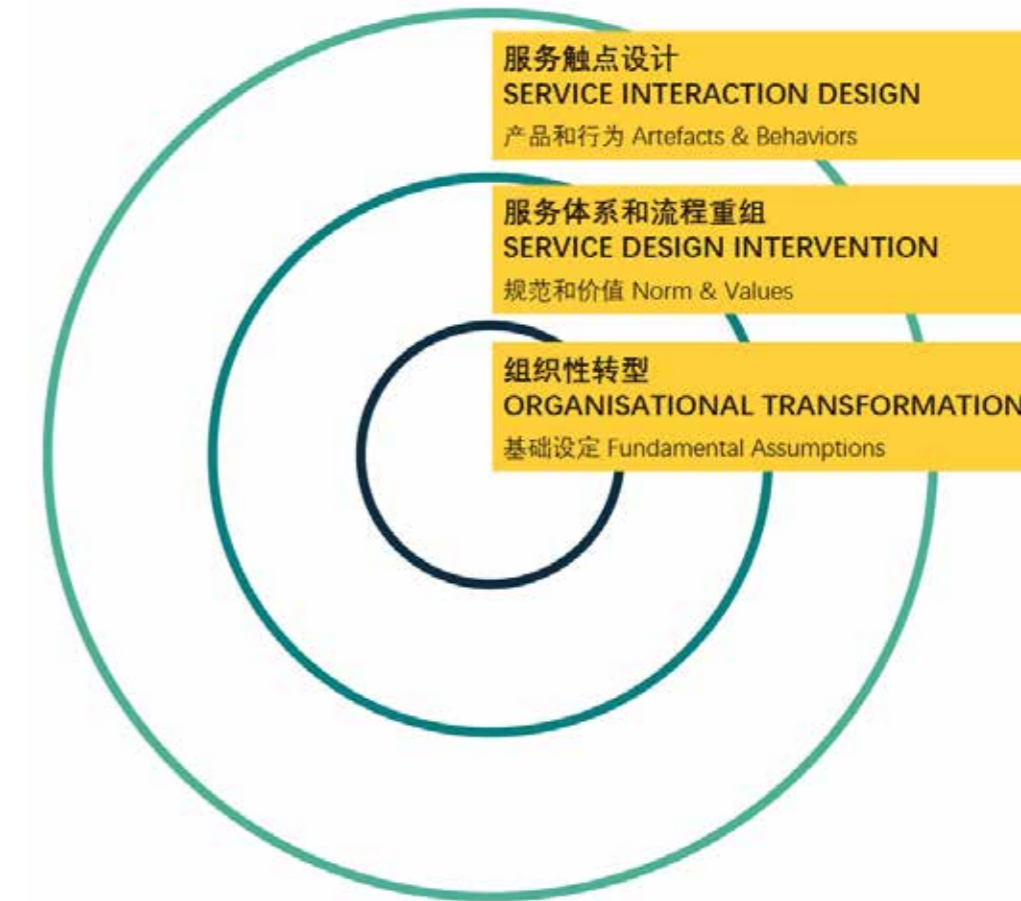
Systemic Redesign Strategy
and Touch Points Design



Service Strategy

Levels of Service Innovation

Service innovation projects of different depths will lead to different results and impacts. According to the design objects and scope of service innovation, Junginger and Sangiorgi (2009) proposed a guiding framework.



Levels of Service Innovation

Service Strategy

Levels of Service Innovation

Service innovation projects can have different depths and derive different results and impacts. Junginger and Sangiorgi (2009) proposed a guided framework based on the design objects and scope of impact of service innovation.

Service interaction design: traditional Service design follows the interactive product interface design and user-centered design knowledge and ability, and focuses on the design and transformation of Service touch point. Changes at this level can be large or small, and the impact can be temporary or long-term. However, if the design improvement still stays at the edge of the system, it is only the update of the interface, without the study of the underlying norms and values, such design innovation may not bring real impact.

Service design intervention: when the Service touch point design involves the Service system or process change, focus on norms and values, the Service design needs to reflect on each element in the system around a new Service experience, research and understand the system itself, and arouse participation to realize the value of the Service innovation system members. If the new service design concept does not affect the deeper fundamental Settings, such service innovation will not bring about radical change.

Organizational transformation: when the concept of service design requires a primary organizational foundation to achieve a deeper transformation, the design may encounter greater resistance. Designers need to use design research to talk to the organization, to reveal the Settings deep within the organization and to understand how these Settings shape the current situation. They need to work together to achieve a Shared vision of how service innovation should work, and to design action plans to implement change. Organizational transformation requires long-term collaboration and a strong commitment from the

organization as a whole.

In the author's opinion, the above framework can help to plan the design improvement scheme of knowledge product service system, sort out different levels of design intervention, and propose holistic service innovation solutions for the problems and demands found in design research from a systematic perspective. Therefore, the author further analyzed and sorted out the design opportunities obtained from the research and classified them according to the different depths involved in the design intervention, respectively corresponding to different levels of service innovation.

See figure on the right, design opportunities derived from different research perspectives can lead to different levels of service innovation design interventions. In other words, some of the problems and requirements identified from the study require only improvements to the service touch points, some require adjustments to the service systems and processes, and some require deep changes within the organization. The hierarchy of these design intervention methods also reflects the system thinking emphasized by the service design method, that is, focusing on the big picture while focusing on the part, and shifting attention back and forth between different system levels (Capra, 1997).

According to the different design objects, the author further clusters the related design opportunities and deduces four specific design project directions. They are open knowledge base design, self-learning classroom design, assignment kit design and open exhibition activity design. Among them, the open knowledge base can respond to the core design requirements and have a broader impact, which will be the object of the author's focus. In the following paper, based on case analysis and theoretical research, the author will put forward detailed improvement strategies for these four directions.

来源于不同研究视角的设计机会 DESIGN OPPORTUNITIES FROM DIFFERENT RESEARCH PERSPECTIVES

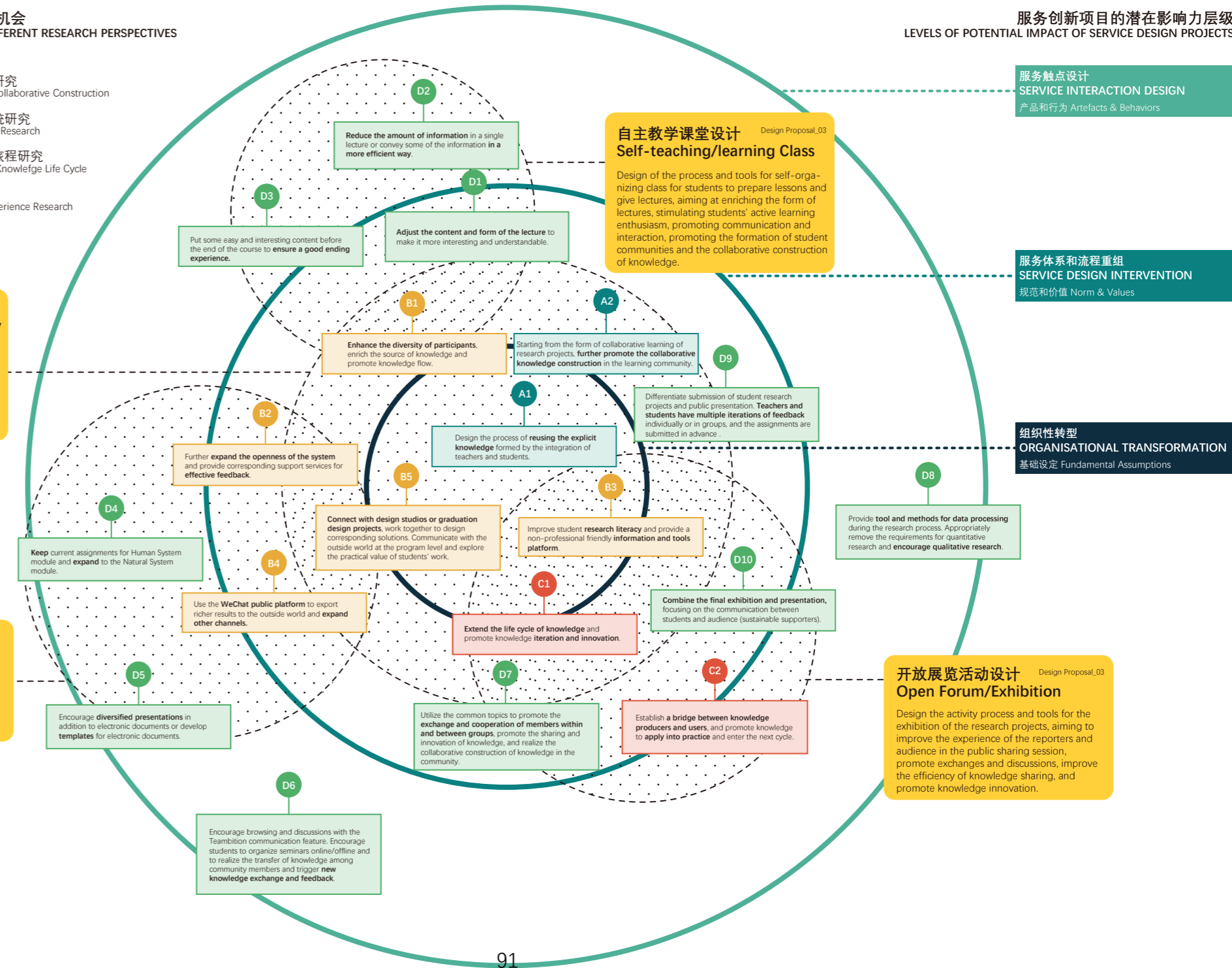
- A 知识转化机制与协同建构研究
Knowledge Transformation and Collaborative Construction
- B 利益相关者与生态系统研究
Stakeholders and Service Ecology Research
- C 基于知识生命周期的用户旅程研究
User Journey Research Based on Knowledge Life Cycle
- D 服务触点与用户体验研究
Service Touch Points and User Experience Research

开放知识库设计 Open Library on Sustainability

Integrate students' research projects over the years into a knowledge library with organizational logic that is open to current students and sustainable supporters. The purpose is to promote the knowledge creation and sharing among the learning community and promote the connection and interaction of learners.

随堂练习工具包设计 Toolkit for Assignments

Provide corresponding template and tool for assignments, so as to assist the students in the knowledge organization and expression, and the unified layout should be suitable for publishing.



Service Strategy

Self-teaching/learning Class

Lecture is the most important service touch point in the process of knowledge service. Teachers or guest speakers combine slides, videos, pictures, blackboard writing and other materials and tools to teach students knowledge and skills related to sustainability. At present, the problems of lectures are that the large amount of information leads to the low efficiency of knowledge absorption, the prolonged lecture time and the low interest of the courses, especially the courses of natural system modules, which are less interested by the students.

In terms of the control of the lecture information, the content of a single lecture can be appropriately reduced under the condition that the current class schedule remains unchanged. Through user surveys or more interesting tests, students' knowledge library, especially commonsense knowledge related to life and nature, can be understood in advance, so as to adjust the knowledge content and depth involved in lectures.

In the form of lectures, in addition to the teacher's lecture, students can try to lecture, seminar or debate and other more diverse forms. For example, the course of natural system module can adopt the form of "autonomous learning classroom". At the beginning of the first class of the course, students in the class can recommend to each other three "natural system representatives" to represent the main components of the natural system, namely "air", "water body" and "land". Other students can then choose to join one of the three teams. Teachers can work with relevant experts to develop the necessary knowledge framework of "air", "water body" and "land", and provide it to each team. "Natural system representative" needs to lead students in the team to carry out division of labor and cooperation, carry out research and sorting out the corresponding knowledge points, and supplement other contents and cases. In the three lectures of the natural system module one month later, one natural system delivered the lecture on behalf of the students who organized the team, and the other two teams were the audience

and judges, who needed to ask questions and score the students' lecture hall. The team with the highest scores after three lessons gets a reward. Such a form can stimulate students' enthusiasm for active learning, promote the communication and interaction among students, and contribute to the formation of student community and the collaborative construction of knowledge.

In terms of the time control and content arrangement of lectures, according to the law of peak and end, some relaxing and interesting contents can be put before the end of the course to ensure a good end-value experience for students. These contents can be said to be related to the knowledge test of the next lesson. As mentioned above, on the one hand, it can understand the students' knowledge foundation and flexibly adjust the knowledge content of the next lesson. Case sharing, documentary footage, interactive games, etc.

Service Strategy

Toolkit for Assignments

At present, the assignment is a small research topic related to the field research and case analysis related to the course content after three classes of the human system module. The assignment is welcomed by students for its close proximity to life, field visits and active research, which have a great impact on students' lifestyle and sustainability. But there are also too much emphasis on the plane expression and time-consuming, causing some pressure to students.

Therefore, on the one hand, we can keep the current practice related to life in the classroom, and even extend it to the natural system module, and try to implement the corresponding small-scale practice related to life in water, air and land. For example, in the subject of "water bodies", students may be required to observe and record the differences between rainwater and sewage pipes in the manhole covers around the college (as shown in the image on the right). In the topic of "air", students can be required to take photos of the weather conditions of the city at a fixed time within a week, observe the air pollution, and find the changes compared with photos of previous years. In the topic of "land", the composting experiment can be carried out in the open space of the college. Please collect the household garbage that can be used for composting and observe and record the progress of composting. These small exercises related to the content of the course can stimulate the curiosity of students and bring the relationship between nature and students closer, so as to enhance students' interest in learning the content of the natural module.

In the display form, diversified display forms can be encouraged or participation can replace the display, such as garbage collection and composting experiments, etc. It is more intuitive and interesting to display the collected household garbage and to participate in and observe the process of non. For assignments that are more suitable for the presentation of electronic documents, such as surveys and photos,

simple templates can be provided to facilitate students to organize and present on the basis of the templates, assist students in knowledge organization and expression, and unified format is also convenient for subsequent release and sharing.



Water Map (image source: BJQ, CHY, TRY, advisor: Mary Polites)

Service Strategy

Research Project

The research project begins in the third week of the course, and is completed in about six weeks by a group of three students who choose their own topics within a given range. As mentioned above, the research project is based on the two dimensions of natural system and human system, which provides a basis for the dialogue and collaborative construction of knowledge in small-scale learning communities with common topics. But at present, students do not carry out effective communication and collaboration. In addition, it is difficult to understand and deal with the data, and it is relatively inefficient to release and share the knowledge due to the tight time of in-class reporting. For this, the author suggests to undertake adjustment from a few respects.

In order to promote the exchange of students based on common topic between collaboration, can be in the project is relatively mature, respectively "clothes" and "food", "places", "mobility" and "waste" small seminar, the same type of topic selection of team members sit together and share their project progress, communication on the research contents and research methods have in common, looking for possible cooperation. For example, groups that also study the impact of food on the environment, the Fried chicken and cola groups can jointly issue environmental reports on "fast food". In addition, previous student groups on the same topic may be invited to participate in the seminar to share previous research projects and provide Suggestions and guidance to current students.

In order to generate more communication and interaction in the process of publishing and sharing research projects, and to promote knowledge sharing and iterative update between students and teachers, the submission of student research projects can be properly distinguished from public display. This provides time and space for feedback iterations of knowledge products between students and teachers and for release and sharing in the student community, respectively. To be specific, two

or three student teams and one teacher team can make an appointment for independent exhibition and communication online or offline, so as to realize knowledge sharing and joint construction of new knowledge between teachers and students and between students and students, and complete iteration and formal submission of research projects. Online communication records can be made public for other students to refer to. And the online submission of the homework as the final time node, no longer organized a unified report within the class.

The focus will be on the release and exchange activities during the exhibition. Different project team members on the exhibition "on site", different time periods to students and teachers and students to visit the other and sustainable followers on their own projects, and launches the discussion, in which teachers and teaching assistants, and past students for guidance and assistance, which leads to the topic or to ask questions, to promote knowledge sharing innovation and collaborative construction.

In fact, open exhibition is a process of knowledge release and sharing through systematic opening to the outside world. Therefore, it is important to obtain feedback from participants and promote the socialflow of tacit knowledge and the collaborative construction of knowledge through interactive communication. Therefore, it is necessary to provide corresponding feedback support service for participants. For example, during the event, the audience can not only communicate with the author on the spot, but also leave comments in paper or electronic ways. At the same time, we encourage online sharing of research projects, assignments, reading recommendations, etc., and open the comment function to encourage readers to participate in the discussion.

Service Strategy

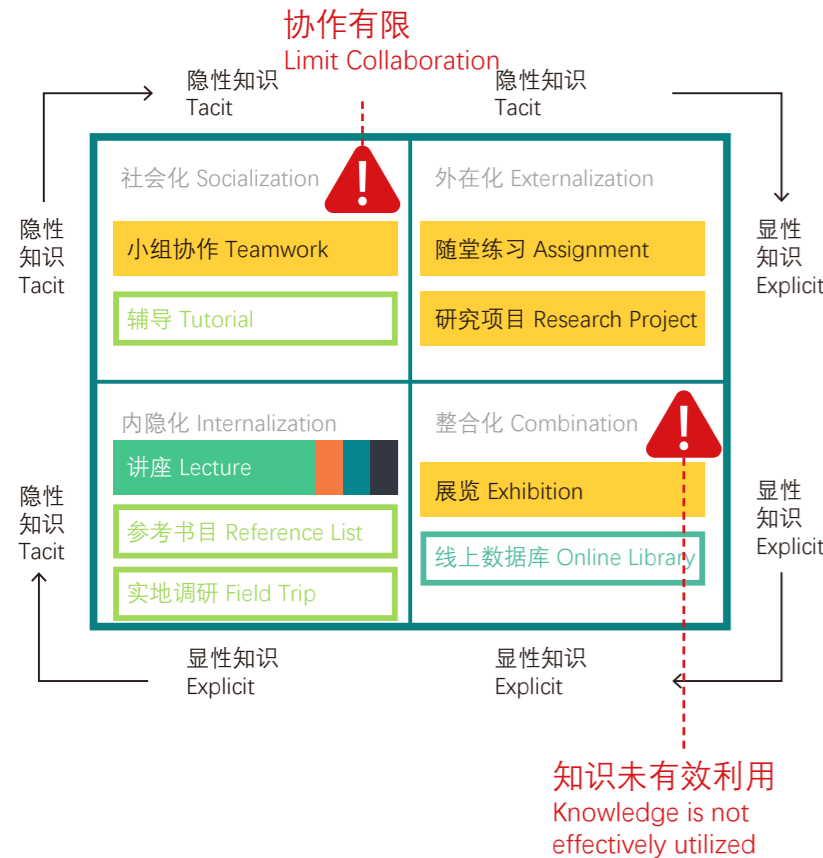
Strately Summary

In this chapter, the author first uses the level of service innovation to sort out the user needs and design opportunities derived from the case analysis, and responds to them with different design projects. The design of an open library based on student research projects helps learners to acquire the explicit knowledge existing in the learning community, and then complete the internalization of individual knowledge and the construction of community public knowledge. It also proposes design improvement strategies for several important service touch points, including self-teaching/learning class, toolkit for assignment, and open forum/exhibition.

The improvement of the service touch points also touched the changes of the service system and processes, that is, the design of the touch points did not stay on the surface of the system, but deepened the value and norm of the service system. The service model of knowledge collaborative construction promotes the reorganization of service systems and processes through changes in service touch points such as lectures, assignments, research projects, and reading lists, in order to optimize the learning experience of knowledge capabilities designed for sustainability and improve learning efficiency and at the meantime, promoting knowledge construction in the learning community. The reorganization of the service system process brought by these designs is shown in the following series of diagrams. It can be seen that a series of new or improved service touch points has enriched the forms of knowledge products and services, promoted collaborative learning among users, enriched the flow and iteration of knowledge, and extended the life cycle of knowledge.

Service Strategy

Contents and Knowledge Transformation · AS IS



外部线上数据库: 微信公众平台 External Online Library: WeChat Public Platform

内部线上数据库 Internal Online Library: Teambition

参考书目 Reference List

辅导 Tutorial

实地考察 Field Trip

B 人类系统 Human System

1. 制造与废弃 Production & Waste

- 收集记录三天的生活垃圾 Collect all your trash in 72 hours
- 上海垃圾路线追踪 Track the trash routes in Shanghai
- 校园垃圾调研 Survey of waste on campus

2. 健康与饮食 Health & Food

- 研究你最喜爱的食物 Study one of your favorite foods
- 健康饮食App调研 Search for APPs on healthy diets

3. 空间与交通 Places & Mobility

- 校园道路步行适宜度调研 Study on walkability on campus

A 导论 Introduction

- 计算自己的生态足迹和地球过载日 Calculate your own ecological footprint/earth overshoot day

系统思维 Systematic Thinking

C 自然系统 Natural System

- 空气 Air
- 水体 Water
- 土地 Land

D 为可持续而设计 Design for Sustainability

- 工具 Tools —— 生命周期评估 Life Cycle Assessment
- 方法 Methods —— 仿生学设计 Inspiration from Nature
- 评估 Evaluation —— 可持续设计评估 Evaluation on DfS
- 案例 Cases —— 循环经济 Circular Economy

从我们日常生活中的衣、食、住、行、弃等诸多方面,选取其中一个侧面(一个具体的物品/材料/行为等),研究人类行为对环境的影响,关注的焦点分别是自然环境系统中的三个方面:大气、水体、土地。并结合相关的设计手段,进一步探索潜在的设计干预方向、策略,以修复或再生被破坏的环境。

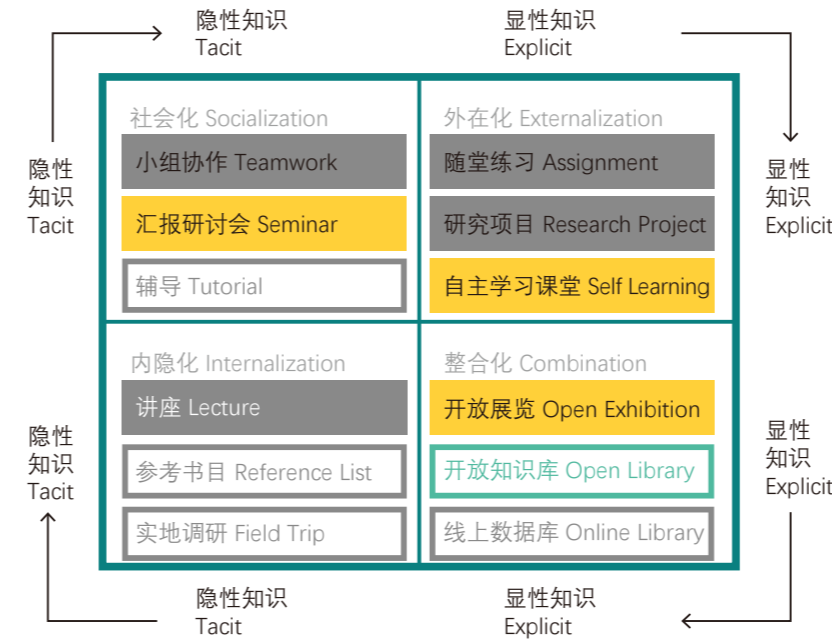
Choose one aspect from the human system (Clothing/ Food/ Places/ Mobility/Waste) to study the impacts on the natural system; focusing on one of the environmental mediums (Air/Water/Land) to learn what dangers we face, what their causes are and how to render them harmless. If possible, explore potential design interventions to restore/ regenerate the environment, i.e. render the impacts positive.

展览: 不同视角下的的可持续议题 Exhibition: Sustainability from Different Perspectives

Service Strategy

Contents and Knowledge Transformation · TO BE

Enrich the knowledge content and form of the curriculum, and promote the process of knowledge socialization, externalization and integration.



可持续开放知识库 Open Library On Sustainability

外部线上数据库: 微信公众平台 External Online Library: WeChat Public Platform

内部线上数据库 Internal Online Library: Teambition

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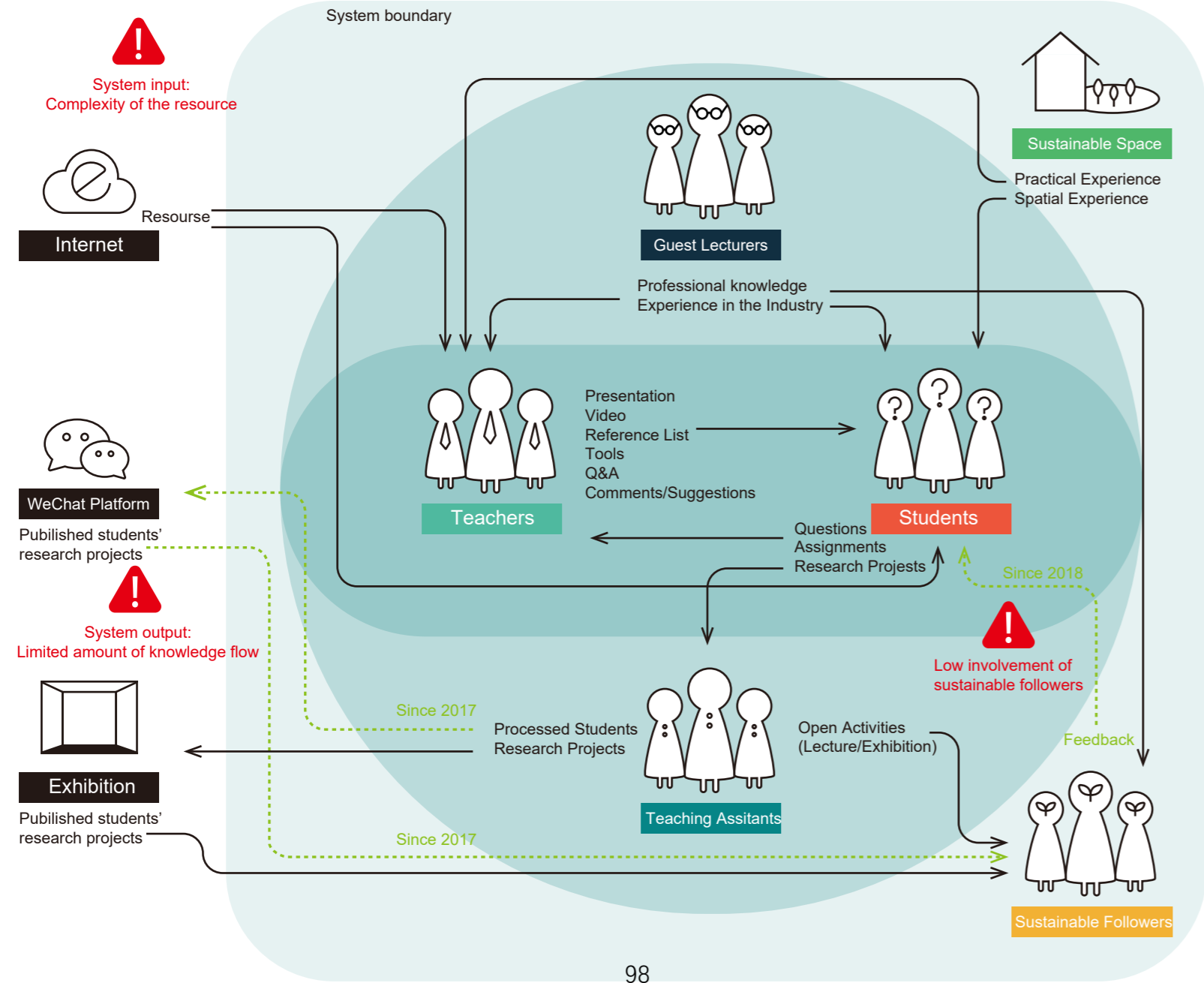
从我们日常生活中的衣、食、住、行、弃等诸多方面,选取其中一个侧面(一个具体的物品/材料/行为等),研究人类行为对环境的影响,关注的焦点分别是自然环境系统中的三个方面:大气、水体、土地。并结合相关的设计手段,进一步探索潜在的设计干预方向、策略,以修复或再生被破坏的环境。

Choose one aspect from the human system (Clothing/ Food/ Places/ Mobility/Waste) to study the impacts on the natural system; focusing on one of the environmental mediums (Air/Water/Land) to learn what dangers we face, what their causes are and how to render them harmless. If possible, explore potential design interventions to restore/ regenerate the environment, i.e. render the impacts positive.

开放展览+汇报分享会: 不同视角下的的可持续议题 Open Exhibition+Seminar: Sustainability from Different Perspectives

Service Strategy

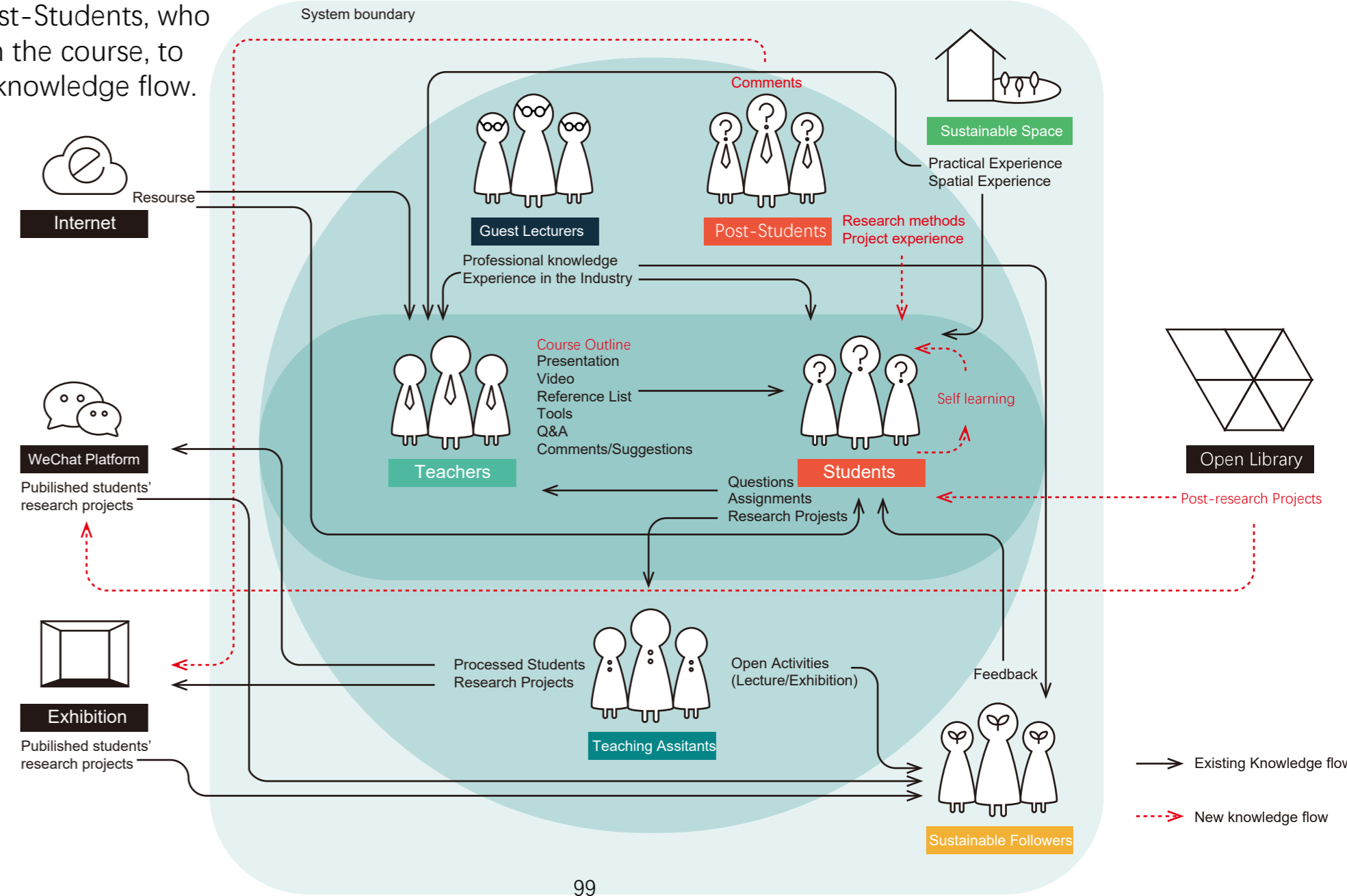
Service Ecology Map · AS IS



Service Strategy

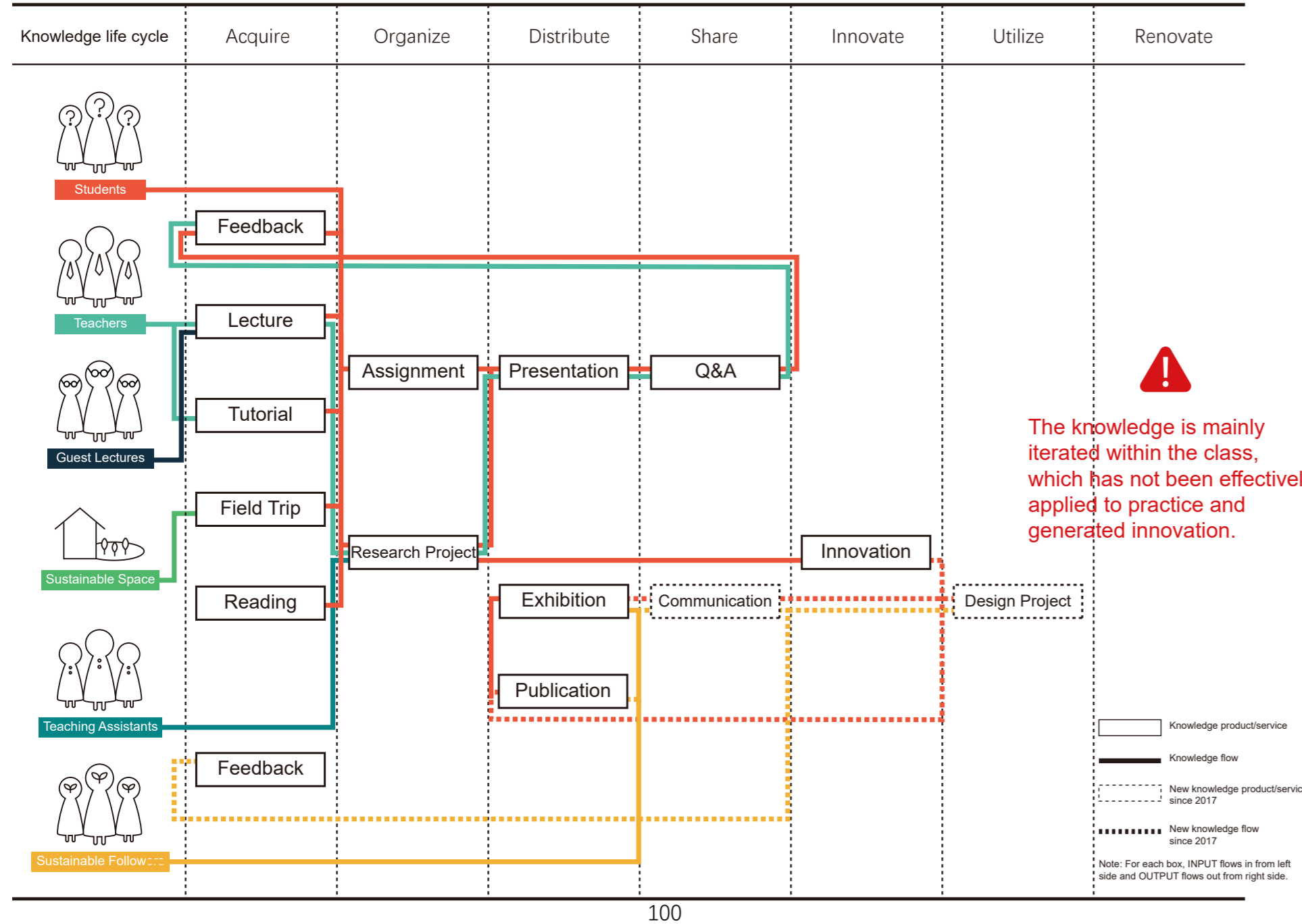
Service Ecology Map · TO BE

Involve Post-Students, who have taken the course, to enrich the knowledge flow.



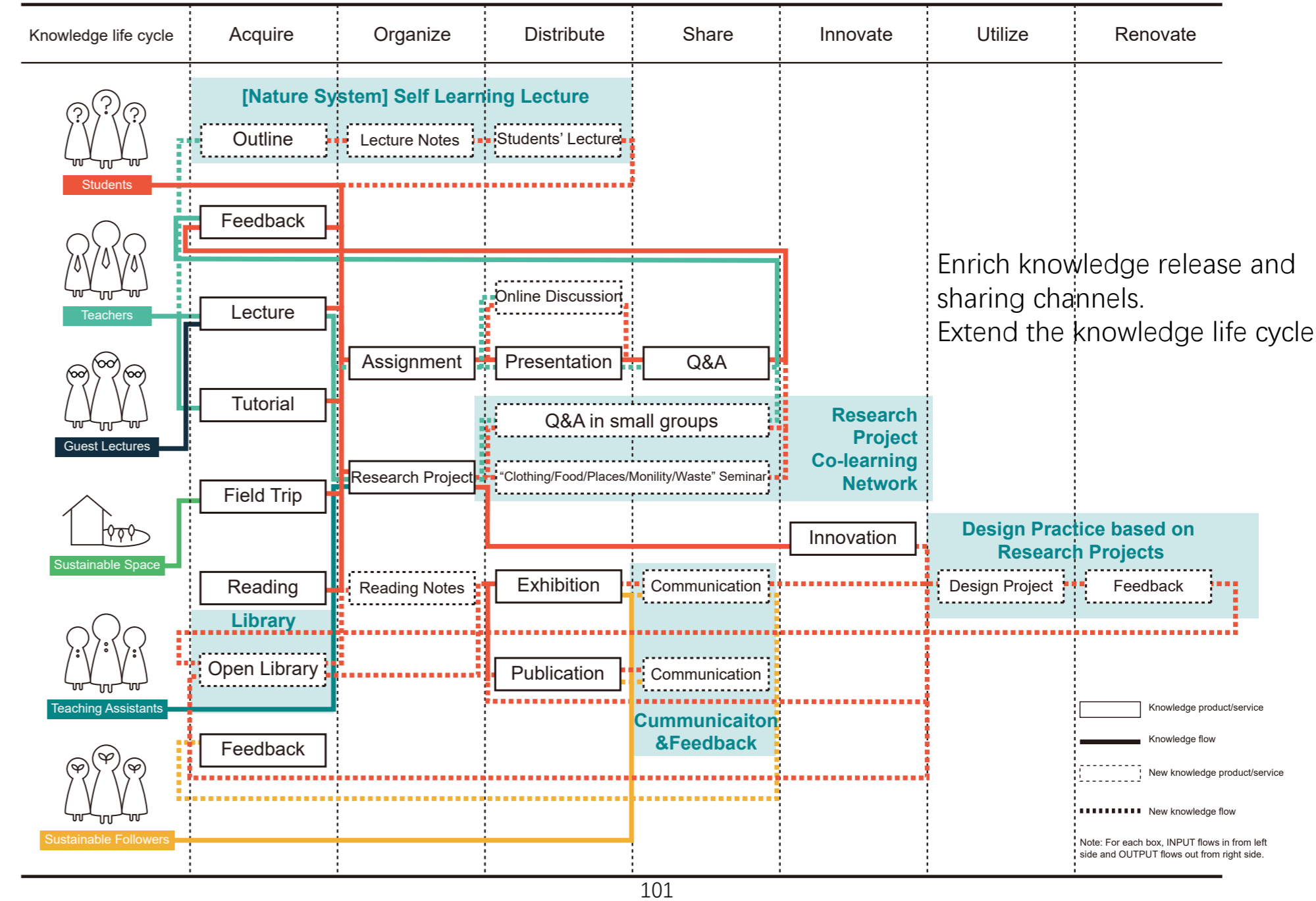
Service Strategy

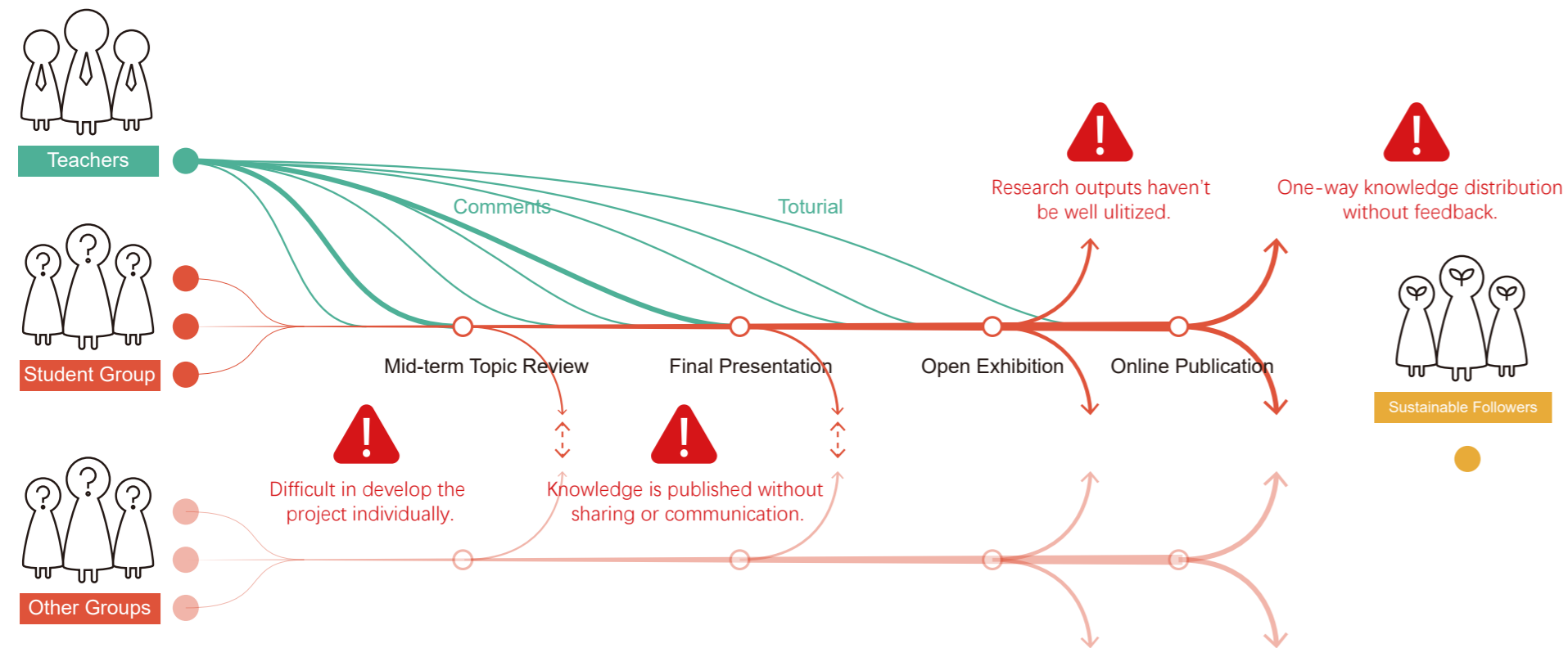
User Journey Map · **AS IS**



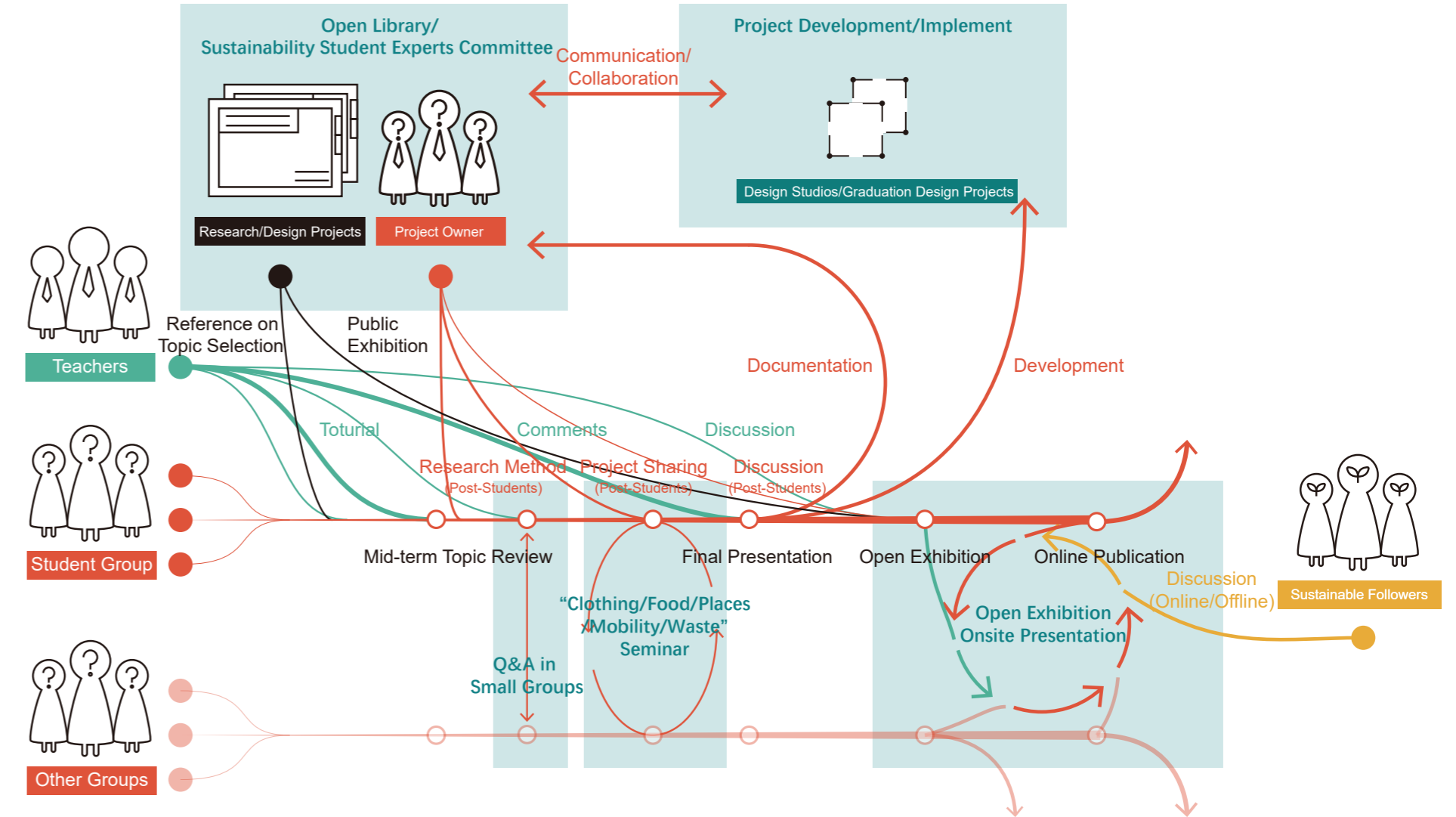
Service Strategy

User Journey Map · **TO BE**



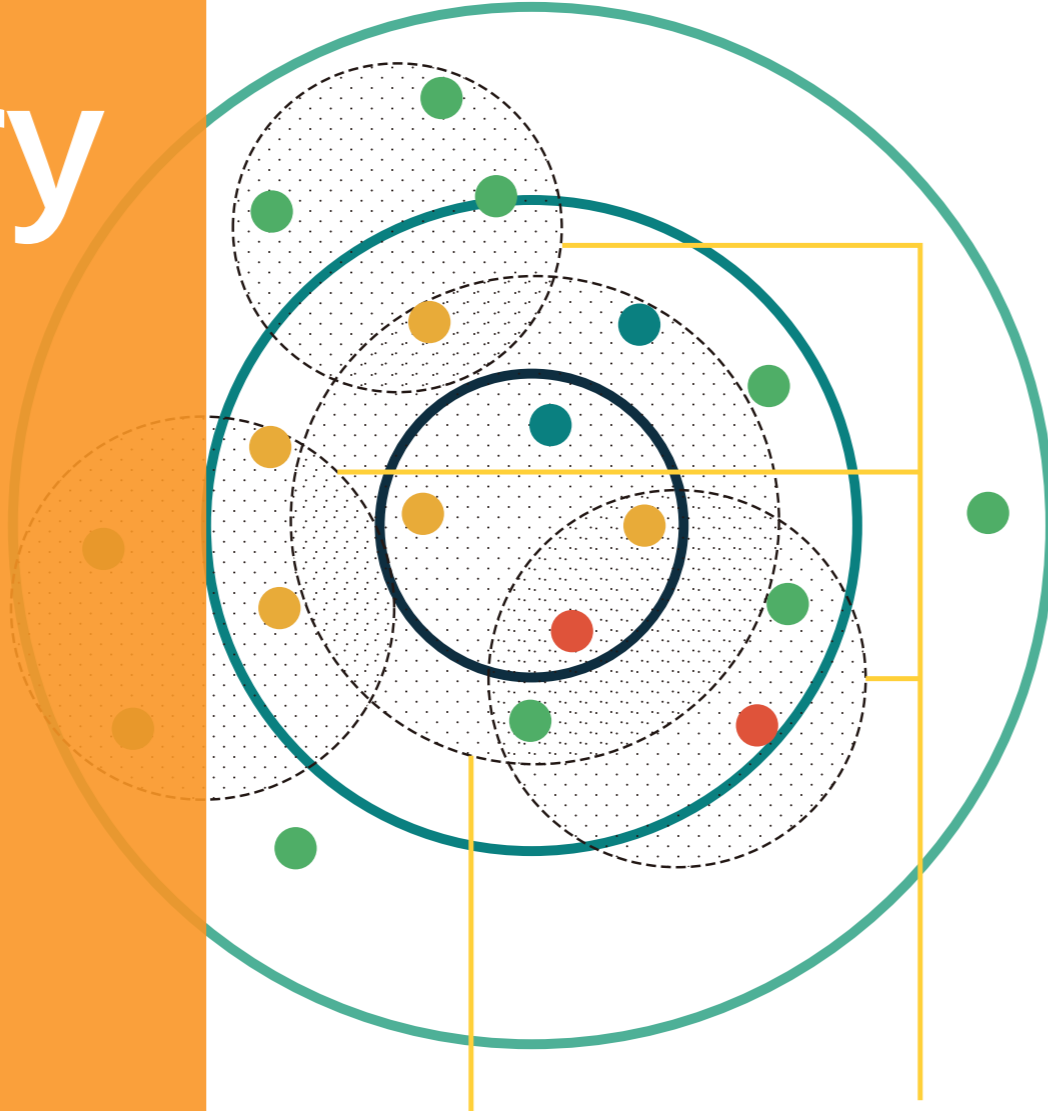


Cross-group communication within the class is achieved through special seminars, inter-course and inter-grade communication through open knowledge library, and two-way communication with sustainable followers through open exhibitions.



4. Open Library Design

How to build an open knowledge library of sustainable knowledge and promote collaboration among learners in the learning community?



1. Prototype of Open Library on Sustainability

Open Library Design

Design Requirements

The design requirements of open knowledge library mainly come from many aspects: first, in the knowledge transformation mechanism, the explicit knowledge that has been integrated in online database or exhibition is not effectively used by students as a knowledge source; Second, from the perspective of the life cycle of knowledge and the sustainability of teaching results, the knowledge in the course of "Sustainability Design Consciousness" has not been well utilized in practice and updated with feedback. Only with the release and sharing of research results, the life cycle of knowledge has room for further extension, and the social value of teaching results can be further improved. Thirdly, from the perspective of knowledge cooperation construction, there is only the cooperation within the student group in the teaching activities, which needs to further promote the effective communication and cooperation in the learning community.

In the author's opinion, the potential of the research project lies in the selection of topics based on the two dimensions of natural system and human system, which provides a foundation for the dialogue and collaborative construction of knowledge in small-scale learning communities with common topics. From the perspective of improving the utilization efficiency of knowledge products and promoting knowledge construction among learning communities, an open and sustainable knowledge library can be established on the basis of the original online database to archive and open the research projects of each class of students. When other students carry out research or design projects, they can find appropriate resources in the knowledge library and student authors who are familiar with this knowledge, deepen or develop on the basis of the original research, or directly cooperate with student authors. Such iteratively updated knowledge can also be sorted out and archived, become the material resources of sustainable design research and practice, and promote the dynamic development of knowledge library.

The author sorted out and made statistics on a total of 78 student research projects produced in the three courses from 2016 to 2018, and classified them according to the topics selected in the two dimensions of natural system and human system, and marked the Numbers to facilitate the management of resources.

Open Library Design

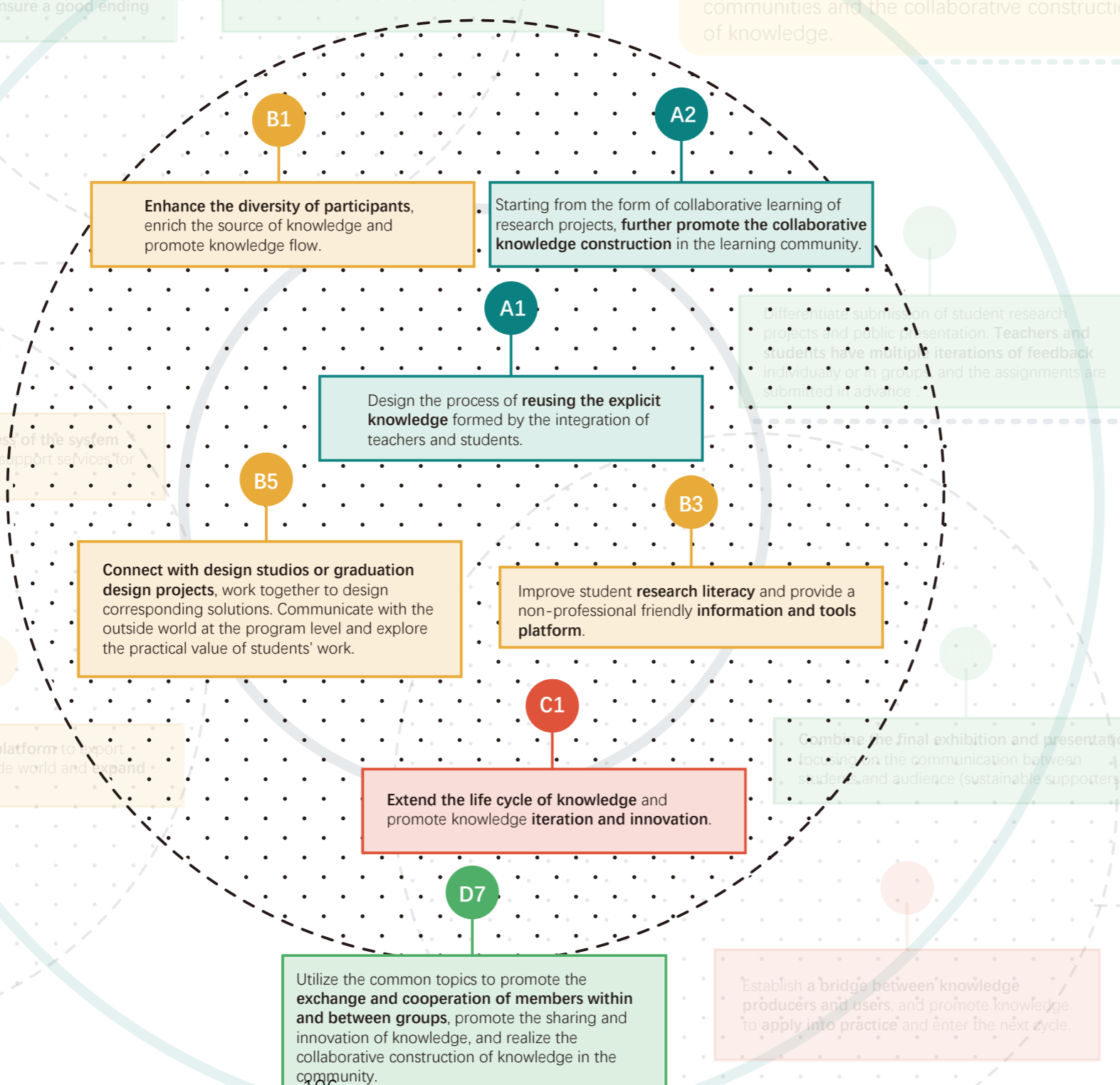
Design Requirements

Open Library on sustainability

An organized and logical knowledge library that gathers student research projects over the years, and is open to every student and sustainable followers.

Goals

Integration // Publish
Communication // Sharing



Open Library Design

Data Collecting

Year 2016 Student Research Projects List

Number of Topics : 34 (Individual Project)

	衣 Clothing	食 Food	住 Places	行 Mobility	弃 Waste
空气 Air		1 有机食品的生产过程与环境的关 The Relatio 关系 1009 Food Air Water Land 2 为什么我们需要减少碳排放? Why we need 黄伟正 1014 Food Air Water Land 3 素食能取代肉食吗? Can we eat 朱碧梅 1015 Food Air Water Land	1 全球气温上升控制范围有多大? Is it possi 李志成 1001 Places Mobility Water Air 2 国家温室气体减排 1009 Places Mobility Water Air 3 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Air Land	1 全球气温上升控制范围有多大? Is it possi 李志成 1001 Places Mobility Water Air 2 国家温室气体减排 1009 Places Mobility Water Air 3 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Mobility Air 4 指定电子垃圾更加有效的回收处理方式? Study on mo 许文静 1008 Waste Air Water Land 5 制定垃圾分类 1009 Places Mobility Water Air 1009 Places Mobility Water Air 6 小声音的大改变 1034 Waste Air	1 全球气温上升控制范围有多大? Is it possi 李志成 1001 Places Mobility Water Air 2 国家温室气体减排 1009 Places Mobility Water Air 3 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Mobility Air 4 指定电子垃圾更加有效的回收处理方式? Study on mo 许文静 1008 Waste Air Water Land 5 制定垃圾分类 1009 Places Mobility Water Air 1009 Places Mobility Water Air 6 小声音的大改变 1034 Waste Air
水 Water	1 我们喝的是什么水? What kind o 黄伟正 1002 Food Water 2 我们的饮食与生物多样性的关系 The relatio 赵琳琳 1007 Food Water Land 3 探索有机农业绿色生产的秘密 The Secret 王碧梅 1008 Food Water Land 4 有机食品的生产过程与环境的关 The Relatio 关系 1009 Food Air Water Land 5 蔬菜种植与水资源的关系? How does th 余荣洪 1010 Food Water Land 6 肉不能停? 肉能不停? Can we stop 蔡文莹 1011 Food Water Land 7 需要减少国内水产养殖吗? Is it need 郭程 1012 Food Water Land 8 为什么我们需要减少碳排放? Why we need 黄伟正 1014 Food Air Water Land 9 素食能取代肉食吗? Can we eat 朱碧梅 1015 Food Air Water Land	1 我们喝的是什么水? What kind o 黄伟正 1002 Food Water 2 我们的饮食与生物多样性的关系 The relatio 赵琳琳 1007 Food Water Land 3 探索有机农业绿色生产的秘密 The Secret 王碧梅 1008 Food Water Land 4 有机食品的生产过程与环境的关 The Relatio 关系 1009 Food Air Water Land 5 蔬菜种植与水资源的关系? How does th 余荣洪 1010 Food Water Land 6 肉不能停? 肉能不停? Can we stop 蔡文莹 1011 Food Water Land 7 需要减少国内水产养殖吗? Is it need 郭程 1012 Food Water Land 8 为什么我们需要减少碳排放? Why we need 黄伟正 1014 Food Air Water Land 9 素食能取代肉食吗? Can we eat 朱碧梅 1015 Food Air Water Land	1 国内耕地利用现状——以“常州香 1004 Places Land 2 土壤多样性与人类活动的关系 Relationship 刘文婧 1006 Health Places Land 3 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Air Land	1 为不同的出行目的选择最合适的出行方 and the mo 郭晓斌 1030 Mobility Land 2 以“网络约车”为代表的交通方式其影响 The shoumei 潘景星 1031 Mobility Land 3 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Air Land	1 城市垃圾焚烧的白烟就只有污水处理? Is waste wa 祝碧梅 1003 Waste Water Land 2 城市生活垃圾分类处理实践方案探讨 The Study o 程亚航 1021 Waste Air Water Land 3 便利区产生的可避免的垃圾——以餐厨 Avoidable r 张信雷 1023 Waste Water Land 4 减少垃圾一定环保吗? ——食品包装 Is reducio 侯博 1024 Waste Air Water Land 5 城市垃圾焚烧的白烟就只有污水处理? Is waste wa 祝碧梅 1003 Waste Water Land 6 便利区产生的可避免的垃圾——以餐厨 Avoidable r 张信雷 1023 Waste Water Land 7 减少垃圾一定环保吗? ——食品包装 Is reducio 侯博 1024 Waste Air Water Land 8 有效的焚烧——垃圾分类对于垃圾焚烧的影 Effective i 廖景星 1025 Waste Land 9 汽车回收都做到报废了吗? Can we make 薛海洋 1026 Waste Land 10 城市垃圾焚烧的白烟就只有污水处理? Is waste wa 祝碧梅 1003 Waste Water Land 11 国家温室气体减排 1009 Places Mobility Water Air 12 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Air Land
土地 Land	1 农业生产与土壤污染的关系及对人类 The relatio 苏晋晋 1005 Health Land 2 土壤多样性与人类活动的关系 Relationship 刘文婧 1006 Health Places Land 3 我们的饮食与生物多样性的关系 The relatio 赵琳琳 1007 Food Water Land 4 探索有机农业绿色生产的秘密 The Secret 王碧梅 1008 Food Water Land 5 有机食品的生产过程与环境的关 The Relatio 关系 1009 Food Air Water Land 6 蔬菜种植与水资源的关系? How does th 余荣洪 1010 Food Water Land 7 肉不能停? 肉能不停? Can we stop 蔡文莹 1011 Food Water Land 8 需要减少国内水产养殖吗? Is it need 郭程 1012 Food Water Land 9 肉不能停? ——可替代农业经济? Meat or veg 赵柯 1013 Food Land 10 为什么我们需要减少碳排放? Why we need 黄伟正 1014 Food Air Water Land 11 素食能取代肉食吗? Can we eat 朱碧梅 1015 Food Air Water Land 12 饮食能影响睡眠质量吗? How Does Sl 赵琳琳 1016 Food Land 13 城市农业是否可以成为解决粮食短缺? Whether urba 杜慧 1017 Food Land 14 城市农业方式——垂直农业系统 Urban Farmi 谢煜星 1018 Food Water Land 15 社区支持农业在中国发展前景 The develop 许宇	1 农业生产与土壤污染的关系及对人类 The relatio 苏晋晋 1005 Health Land 2 土壤多样性与人类活动的关系 Relationship 刘文婧 1006 Health Places Land 3 我们的饮食与生物多样性的关系 The relatio 赵琳琳 1007 Food Water Land 4 探索有机农业绿色生产的秘密 The Secret 王碧梅 1008 Food Water Land 5 有机食品的生产过程与环境的关 The Relatio 关系 1009 Food Air Water Land 6 蔬菜种植与水资源的关系? How does th 余荣洪 1010 Food Water Land 7 肉不能停? 肉能不停? Can we stop 蔡文莹 1011 Food Water Land 8 需要减少国内水产养殖吗? Is it need 郭程 1012 Food Water Land 9 肉不能停? ——可替代农业经济? Meat or veg 赵柯 1013 Food Land 10 为什么我们需要减少碳排放? Why we need 黄伟正 1014 Food Air Water Land 11 素食能取代肉食吗? Can we eat 朱碧梅 1015 Food Air Water Land 12 饮食能影响睡眠质量吗? How Does Sl 赵琳琳 1016 Food Land 13 城市农业是否可以成为解决粮食短缺? Whether urba 杜慧 1017 Food Land 14 城市农业方式——垂直农业系统 Urban Farmi 谢煜星 1018 Food Water Land 15 社区支持农业在中国发展前景 The develop 许宇	1 国内耕地利用现状——以“常州香 1004 Places Land 2 土壤多样性与人类活动的关系 Relationship 刘文婧 1006 Health Places Land 3 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Air Land	1 为不同的出行目的选择最合适的出行方 and the mo 郭晓斌 1030 Mobility Land 2 以“网络约车”为代表的交通方式其影响 The shoumei 潘景星 1031 Mobility Land 3 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Air Land	1 城市垃圾焚烧的白烟就只有污水处理? Is waste wa 祝碧梅 1003 Waste Water Land 2 城市生活垃圾分类处理实践方案探讨 The Study o 程亚航 1021 Waste Air Water Land 3 便利区产生的可避免的垃圾——以餐厨 Avoidable r 张信雷 1023 Waste Water Land 4 减少垃圾一定环保吗? ——食品包装 Is reducio 侯博 1024 Waste Air Water Land 5 城市垃圾焚烧的白烟就只有污水处理? Is waste wa 祝碧梅 1003 Waste Water Land 6 便利区产生的可避免的垃圾——以餐厨 Avoidable r 张信雷 1023 Waste Water Land 7 减少垃圾一定环保吗? ——食品包装 Is reducio 侯博 1024 Waste Air Water Land 8 有效的焚烧——垃圾分类对于垃圾焚烧的影 Effective i 廖景星 1025 Waste Land 9 汽车回收都做到报废了吗? Can we make 薛海洋 1026 Waste Land 10 城市垃圾焚烧的白烟就只有污水处理? Is waste wa 祝碧梅 1003 Waste Water Land 11 国家温室气体减排 1009 Places Mobility Water Air 12 我们到底花了多少寸土寸金的交地-建筑? We eat 李俊强 1033 Places Air Land

Year 2017 Student Research Projects List

Number of Topics : 22 (Individual Project)

	衣 Clothing	食 Food	住 Places	行 Mobility	弃 Waste	
空气 Air	1 一支口红如何影响全球变暖? 化妆品学 How does a lipstick affect global warming? 成佳颖	1 从一部手机看全球变暖现象 Look at the mobile phone to see global warming 宋睿岳	1 从水垢看其对空气的影响 To know the effect of water scale on air 许佳艺	1 共享单车是环保出行吗? Is sharing bike friendly? 梁奕彤	1 牛皮纸袋-环保包装? -牛皮纸的CA回收 Are Arca's paper bags eco-friendly? 李欣悦	
	1701 Clothing/Air	1706 Food/Air	1714 Places/Air	1717 Mobility/Air	1703 Waste/Air	
	2 你真的会用纸吗? ——纸屑使用调查 Do you really use paper? 郭露露	2 你真的会用纸吗? ——纸屑使用调查 Do you really use paper? 郭露露	2 好的木材家具经过森林认证了吗? Does your good wood furniture have forest certification? 刘富博	2 共享单车出行如何阻止了别人绿色出行? How do we stop others from green travel? 韩正博	2 共享单车出行如何阻止了别人绿色出行? How do we stop others from green travel? 韩正博	
	1707 Food/Air	1707 Food/Air	1719 Places/Air	1718 Mobility/Air		
	3 为什么海水变暖导致海平面上升? How warming of the sea causes sea level rise? 吴凡	3 为什么海水变暖导致海平面上升? How warming of the sea causes sea level rise? 吴凡	3 上海中法水务集团改善后空气质量了吗? Has the Shanghai Suez Canal improved the air quality? 胡明	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
1708 Food/Air	1708 Food/Air		1719 Mobility/Air			
			4 电动汽车比传统燃油汽车更环保吗? Is electric car more eco-friendly? 黄文心	4 电动汽车比传统燃油汽车更环保吗? Is electric car more eco-friendly? 黄文心		
			1720 Mobility/Air	1720 Mobility/Air		
			5 “少开车, 靠红纸” ——社交媒体对“Less drive”的影响 How does social media affect "Less drive"? 杨德宇	5 “少开车, 靠红纸” ——社交媒体对“Less drive”的影响 How does social media affect "Less drive"? 杨德宇		
			1721 Mobility/Air	1721 Mobility/Air		
水 Water		1 为什么自杀生会在最后一公里“被救援”? Why is the last mile of suicide prevention? 张清	1 接错了排水管的水龙头 The washing machine water tap 魏羽丹			
		1709 Food/Water	1716 Places/Water			
		2 做一杯奶茶只浪费一杯水吗? Can you make a cup of milk tea with only one cup of water? 罗宇平				
		1710 Food/Water				
土地 Land	1 有机肥料真的有益于环境吗? 一行好有机 Are organic fertilizers good for the environment? 张宇楠	1 好吃的东西总是重金属? What are your favorite foods heavy metal? 于会哲	1 一辆车“占”用了多少资源? How much do cars use? 杨晨航	1 好饮料罐真的可以回收吗? Are good cans really recyclable? 叶书祺		
	1712 Clothing/Land	1711 Food/Land	1722 Mobility/Land	1706 Waste/Land		
		2 厨余垃圾怎么处理成土壤? How is the kitchen waste treated to become soil? 高雨				
		1712 Food/Land				
		3 塑料垃圾真的能回收吗? Will all plastic waste be recycled? 陈丹怡				
		1713 Food/Land				

Year 2018 Student Research Projects List

Number of Topics : 32 (Group Project)

	衣 Clothing	食 Food	住 Places	行 Mobility	弃 Waste
空气 Air	1 指尖的隐形杀手——指甲油中的挥发性有机物 The hidden killer on fingertips - VOCs in nail polish 魏晓霞	1 化妆品生产及包装对空气产生了多少影响 How much do cosmetics production and packaging affect the air? 左颖琳	1 传统式空气净化器使用中的二次污染 Secondary pollution in traditional air purifiers 陈雨晴	1 数据中心: 去噪到“去噪”——一项调研 Data Center: Denoising to "denoising" - A survey 曹天翔	1 共享单车回收多少量? How much do sharing bikes recycle? 陈超群
	1811 Clothing/Air	1802 Food/Air	1801 Places/Air	1804 Mobility/Air	1806 Waste/Air
	2 冰箱制冷剂对臭氧层的影响? What's a CFC? 李俊豪	2 一个三口之家每周消耗多少塑料? Impact of CFC on ozone layer 王雨桐	2 城市空气环境下行进的两种选择 Comparison of two choices in urban air environment 魏雨晴	2 共享单车回收多少量? How much do sharing bikes recycle? 陈超群	2 共享单车回收多少量? How much do sharing bikes recycle? 陈超群
	1812 Clothing/Air	1803 Food/Air	1832 Places/Air	1830 Mobility/Air	1806 Waste/Air
	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天
	1813 Clothing/Air	1806 Food/Air		1808 Waste/Air	1831 Mobility/Air
	4 空气中的点基量有八成来自哪里? How much do point sources contribute to air pollution? 王宇恒	4 共享单车如何改善空气? How does sharing bike improve air? 王宇恒	4 共享单车如何改善空气? How does sharing bike improve air? 王宇恒	4 共享单车如何改善空气? How does sharing bike improve air? 王宇恒	4 共享单车如何改善空气? How does sharing bike improve air? 王宇恒
	1814 Clothing/Air	1827 Food/Air		1809 Waste/Air	1809 Waste/Air
	5 为了降低大气污染付出什么代价? What does it cost to reduce air pollution? 魏晓霞	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天
	1815 Clothing/Air	1828 Food/Air		1810 Waste/Air	1810 Waste/Air
	6 点基量造成空气污染的成分研究及其减排 Study on the components of point sources and their reduction 张睿天	6 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	6 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	6 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	6 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天
	1816 Clothing/Air	1829 Food/Air		1811 Waste/Air	1811 Waste/Air
7 点基量的去向与减排(水) Decontamination of point sources (water) 田宇	7 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	7 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	7 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	7 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
1817 Clothing/Air	1807 Food/Air		1812 Waste/Air	1812 Waste/Air	
8 点基量对臭氧层的影响? How does point source affect ozone layer? 苏宇宏	8 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	8 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	8 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	8 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
1818 Clothing/Air	1808 Food/Air		1813 Waste/Air	1813 Waste/Air	
9 制冰机和饮水机对空气的影响 The impact of ice makers and water dispensers on air 杨晨航	9 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	9 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	9 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	9 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
1819 Clothing/Air	1809 Food/Air		1814 Waste/Air	1814 Waste/Air	
10 飞机尾气对环境的影响? The impact of aircraft exhaust on the environment 叶书祺	10 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	10 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	10 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	10 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
1820 Clothing/Air	1808 Food/Air		1815 Waste/Air	1815 Waste/Air	
11 “金猪”的尾气污染 Air pollution from gold pigs 于会哲	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
1821 Clothing/Air	1807 Food/Air		1816 Waste/Air	1816 Waste/Air	
12 塑料生产量对环境的影响 Impact of plastic production on the environment 魏晓霞	12 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	12 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	12 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	12 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
1822 Clothing/Air	1809 Food/Air		1817 Waste/Air	1817 Waste/Air	
水 Water	1 防晒霜的防晒效果如何? How effective is sunscreen? 张宇楠	1 化妆品生产及包装对水体的影响 How much do cosmetics production and packaging affect water? 左颖琳	1 为了留住一滴水, 我们浪费和污染了多少? How much water do we waste and pollute to keep a drop? 魏晓霞	1 共享单车回收多少量? How much do sharing bikes recycle? 陈超群	
	1806 Clothing/Water	1802 Food/Water	1801 Places/Water	1804 Mobility/Water	
	2 指甲油真的越来越环保了吗? 指甲油 Is nail polish getting greener? 魏晓霞	2 一个三口之家每周消耗多少塑料? Impact of CFC on ozone layer 王雨桐	2 城市空气环境下行进的两种选择 Comparison of two choices in urban air environment 魏雨晴	2 共享单车回收多少量? How much do sharing bikes recycle? 陈超群	
	1811 Clothing/Water	1803 Food/Water	1832 Places/Water	1830 Mobility/Water	
	3 水体污染对臭氧层的影响? How does water pollution affect ozone layer? 魏晓霞	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
	1812 Clothing/Water	1806 Food/Water		1808 Waste/Water	
	4 你喝的水有多少是点基? How much water is from point sources? 魏晓霞	4 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	4 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	4 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
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	5 你真的会用纸吗? ——纸屑使用调查 Do you really use paper? 郭露露	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
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	6 自行车——从水污染到水污染? From water pollution to water pollution? 魏晓霞	6 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	6 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	6 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
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1819 Clothing/Water	1809 Food/Water		1815 Waste/Water		
11 自来水“被污染”了吗? ——自来水污染? Is tap water polluted? 魏晓霞	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天		
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12 清洁的自来水? Clean tap water? 魏晓霞	12 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	12 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	12 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天		
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1822 Clothing/Water	1809 Food/Water		1818 Waste/Water		
土地 Land	1 二氧化碳的累积对土壤是利是弊? Is CO2 accumulation good or bad for soil? 魏晓霞	1 化妆品生产及包装对土壤的影响 How much do cosmetics production and packaging affect soil? 左颖琳	1 活性碳滤网在土壤中的应用研究 Research on the application of activated carbon filter in soil 王康康	1 共享单车回收多少量? How much do sharing bikes recycle? 陈超群	
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	1811 Clothing/Land	1803 Food/Land	1832 Places/Land	1830 Mobility/Land	
	3 塑料垃圾真的能回收吗? Will all plastic waste be recycled? 陈丹怡	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	3 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
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	5 点基量对土壤是利是弊? Which is more beneficial to soil, point sources or non-point sources? 魏晓霞	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	5 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	
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11 寸金难买寸土地? An inch of gold can't buy an inch of land? 魏晓霞	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天	11 共享单车的碳排放量有多少? How much carbon dioxide does sharing bike emit? 张睿天		
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Open Library Design

Appearance and Form

A knowledge map composed of triangle elements that can be spliced and grows, and carries sets of topic cards representing different research project.



Goals | Forms
Integration // Publish // Communication // Sharing

- **Physical Model**

Foldable Map
+Topic Cards with QR code

Applicable for:
Exhibition/Event



- **Offline Digital Document**

Interactive PDF Map
+Project PDF attachments

Applicable for:
Documentation



- **Online Data Base**

Website/WeChat Public Platform

Applicable for:
Sharing / Search and Preview

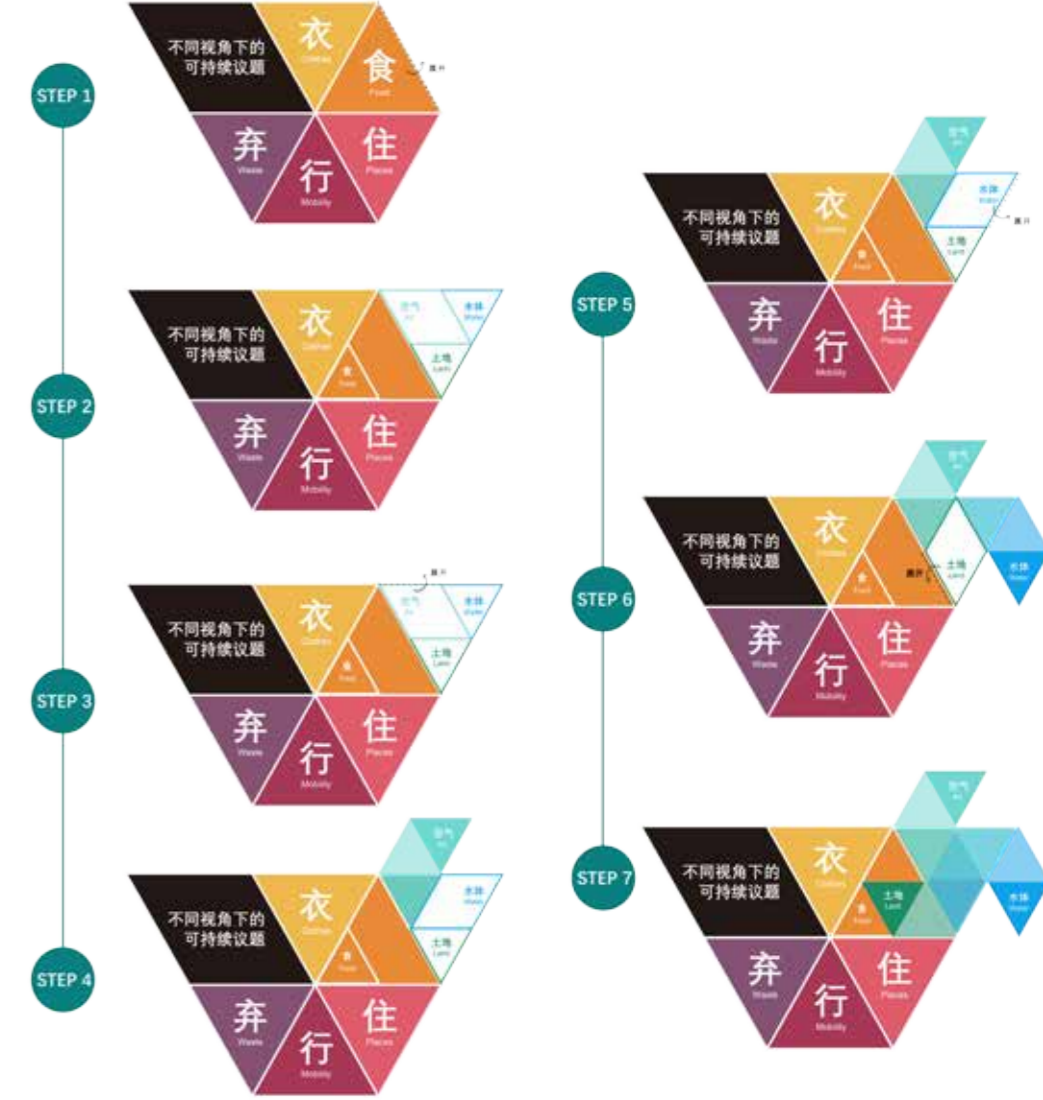


Open Library Design

Appearance and Form

The logical structure of the open knowledge library should be based on the two dimensions of the existing natural system and human system of the curriculum, and embody the characteristics of the integrity and interrelation of sustainable knowledge. The main contents of the open knowledge library are the research projects formed by previous students in the course of "Sustainability Design Consciousness". In addition, the open knowledge library can also contain the tools, data materials and design cases related to the research projects. The first version of the open knowledge library carrier will be a combination of digital media and physical model. See the appendix for mock-ups.

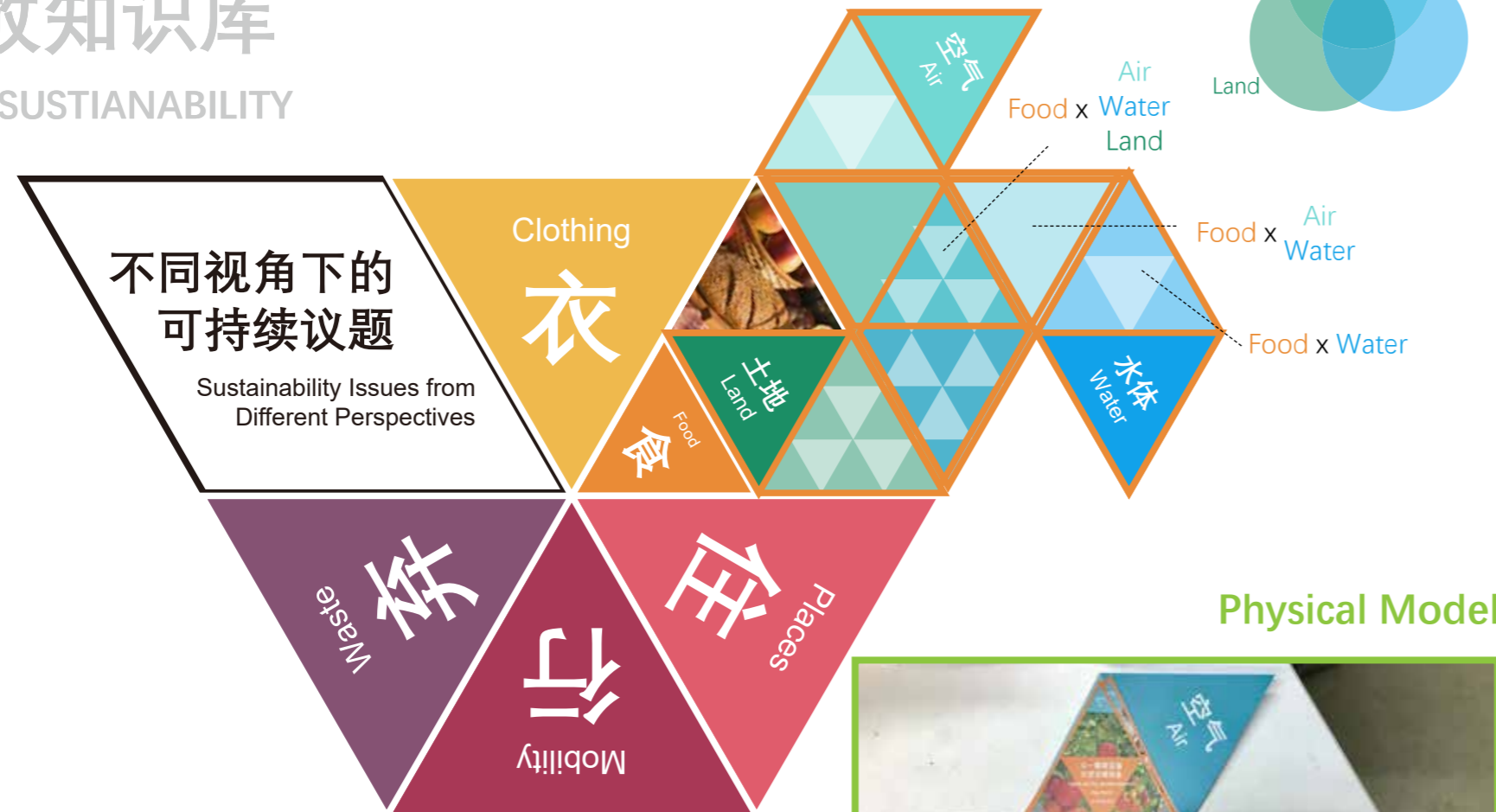
Specifically, mock-ups include knowledge maps and project cards. The knowledge map is a foldable background drawing composed of multiple equilateral triangles to explain the relationship between the human system represented by "food, clothing, places, mobility and abandon" and the natural system represented by "air, water and land" discussed in the research project.



Expansion Process of Knowledge Map

可持续开放知识库

OPEN LIBRARY ON SUSTIANABILITY



Physical Model



Open Library Design

Appearance and Form

As shown in FIG. 5.3-5.5, the folded state of the knowledge map presents five major themes of the human system composed of five triangles of different colors: "clothing", "food", "places", "mobility" and "waste". Turning over one of the themes, we can see "air", "water", "land" three different colors of the diamond superposition of the natural system of the three areas. On the three diamond respectively, is presented by "air", "water", "land" three areas overlapping Wayne figure, central area represents the "air", "water" and "land" fragrance of subject area, next to the three area represents the "air", "water", "land" two intersecting subject area, monochrome area around is "air", "water", "land" independent subject area.

The division of topic areas on the knowledge map corresponds to the direction of students' research projects. For example, the research direction of "the relationship between the production process of organic food and the environment" is the relationship between "food" and "air", "water" and "land", so this research project should be placed in the topic area of "food | air + water + land". And "does it only take a cup of water to make a cup of milk tea?" The research is about the relationship between "food" and "water", so this topic belongs to the topic area of "water".

Another component of the mock-up is the project card / knowledge card. Each student research project has a corresponding knowledge card containing the main information related to the research project. It is a card as large as the smallest equilateral triangle unit in the knowledge map. Take the color of the corresponding field in "clothing - food - housing - line - abandon" as the theme background color. On the front, the research object is used as the picture background to present the topic of the research project and the text information of the research problem. The three corners represent the natural system labels related to the topic. On the back is the main conclusion of the research and the QR code that links to WeChat or the website to read the full text to realize the connection between mock-ups and digital media.



Project Card

可持续开放知识库

OPEN LIBRARY ON SUSTIANABILITY

不同视角下的 可持续议题

Sustainability Issues from
Different Perspectives



Open Library Design

Appearance and Form

The fully expanded state of the knowledge map is like a kaleidoscope. The knowledge CARDS for each research project can be found in the corresponding topic area and placed separately. The translucent triangle in the region represents the density of existing research topics in the corresponding field. The fully expanded knowledge map provides learners with an Holistic Perception of "sustainable issues from different perspectives", guides them to understand the overview of various research directions, and helps them find relevant research in their areas of interest. At the same time, the form of knowledge map contains the interaction between human and nature coupling system. Under the framework of knowledge map, learners can find the internal connection between different research projects, so as to exercise the systematic thinking mode.



可持续开放知识库

OPEN KNOWLEDGE BASE ON SUSTIANABILITY



"环保外卖餐盒"真的环保吗?

Are green containers really environmentally friendly?

不同材料外卖餐盒的全生命周期生态效应分析

Ecological effect analysis based on LCA of food containers of different materials



外卖有多火? 外卖业务的爆发造成了餐盒的过量使用。有环保组织研究分析了 100 个外卖订单发现, 平均每单外卖会消耗 3.27 个一次性塑料餐盒 / 杯。这意味着, 目前中国互联网订餐平台上, 每天使用的塑料餐盒超过 6000 万个。
——《人民日报海外版》

空气 Air

水体 Water

土地 Land

空气 Air

水体 Water

土地 Land

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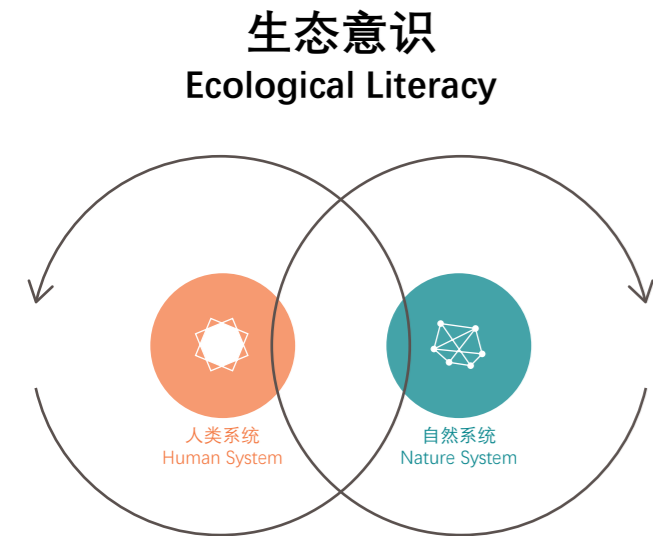
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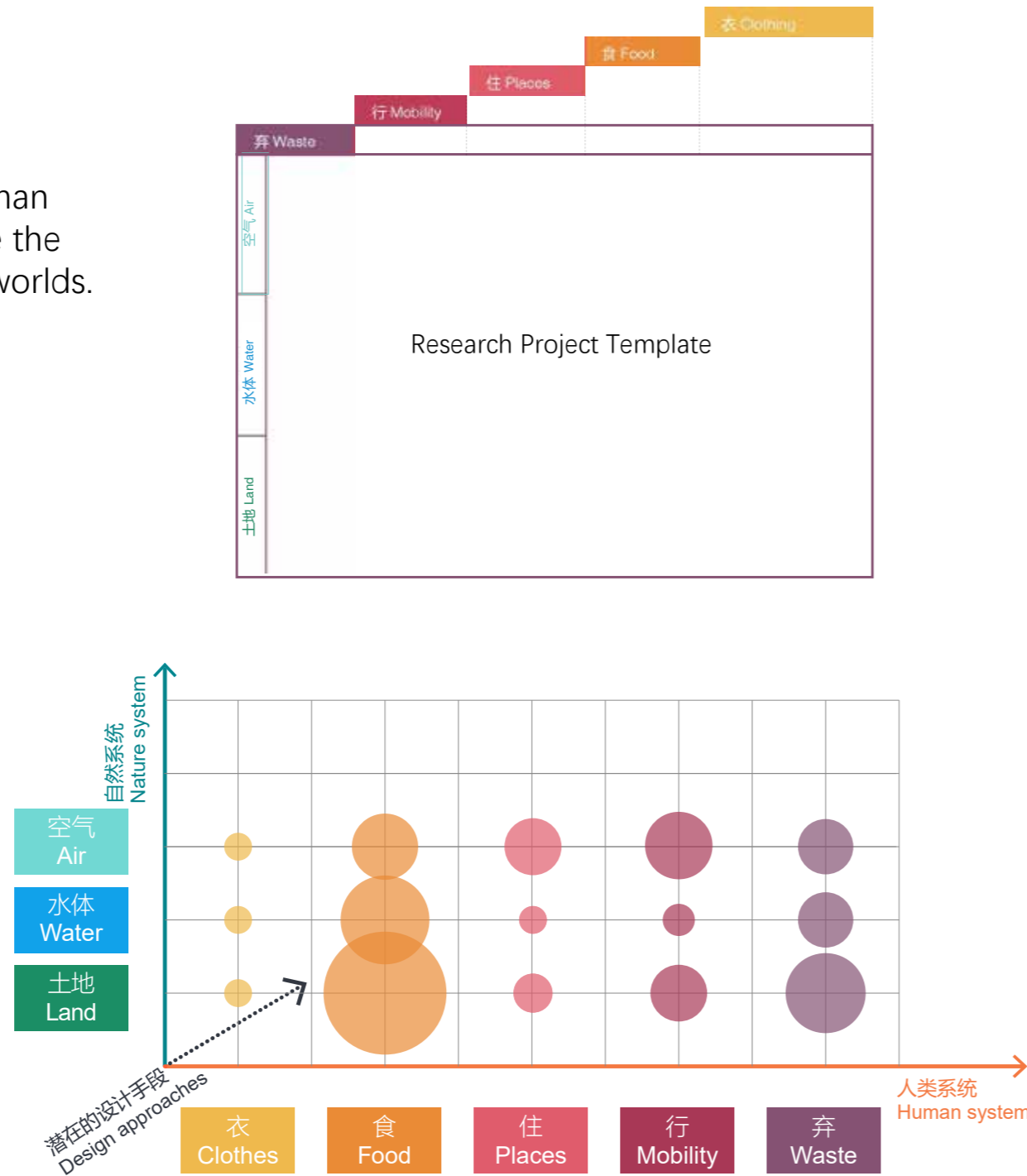
Open Library Design

Research Project Template

The research project template sets up a two-dimensional labeling system that connects human and natural systems. Guide students to explore the interrelationship between natural and human worlds.

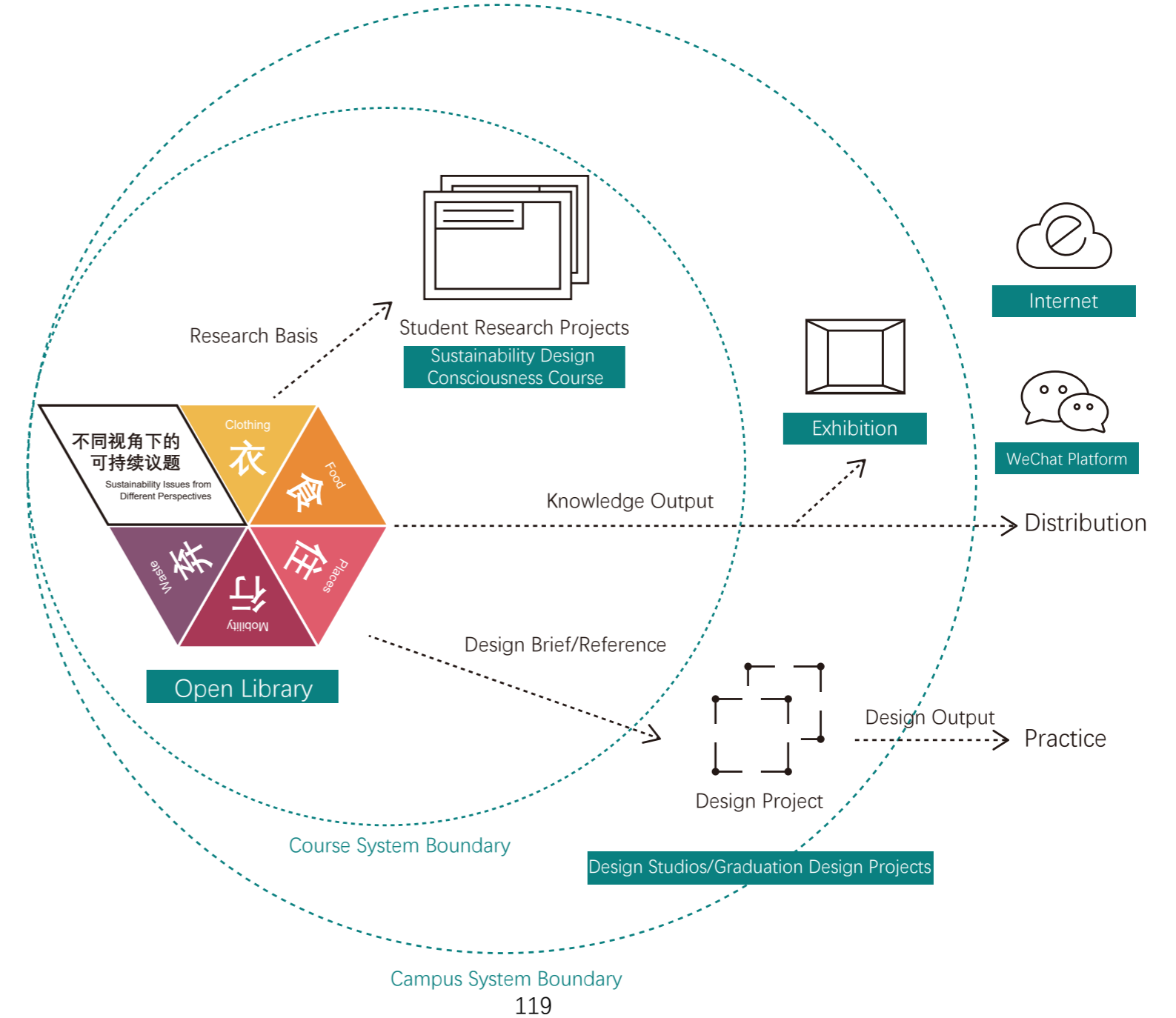


整体感知 Holistic Perception



Open Library Design

Use Scenarios



Open Library Design

Use Scenarios

The establishment of open knowledge library provides many possibilities for the flow and utilization of knowledge products of community public knowledge.

Within the curriculum system, the open knowledge library, as an combination of explicit knowledge in the learning community, can be used as an important explicit knowledge source, combined with teaching activities such as lectures, reading and assignments, to provide students with knowledge related to sustainability. In addition, in each year "Sustainability Design Consciousness" course student research project development process, can provide the student with the topic selection reference and the research foundation.

Expand to the campus system, the "Sustainability Design Consciousness" course based on theoretical research can be connected and cooperated with the design professional courses or graduation design projects based on design practice, and the research project in the open knowledge library can be used as the design task book to design corresponding solutions in the design professional courses or graduation design projects. Then, we communicate with the outside world at the level of the solution, carry out further cooperation with stakeholders, and explore its practical value. In addition, mock-ups of knowledge maps and knowledge CARDS can be used in the exhibition to guide the audience to deepen their understanding of sustainability in the process of actually folding the map or reading the CARDS.

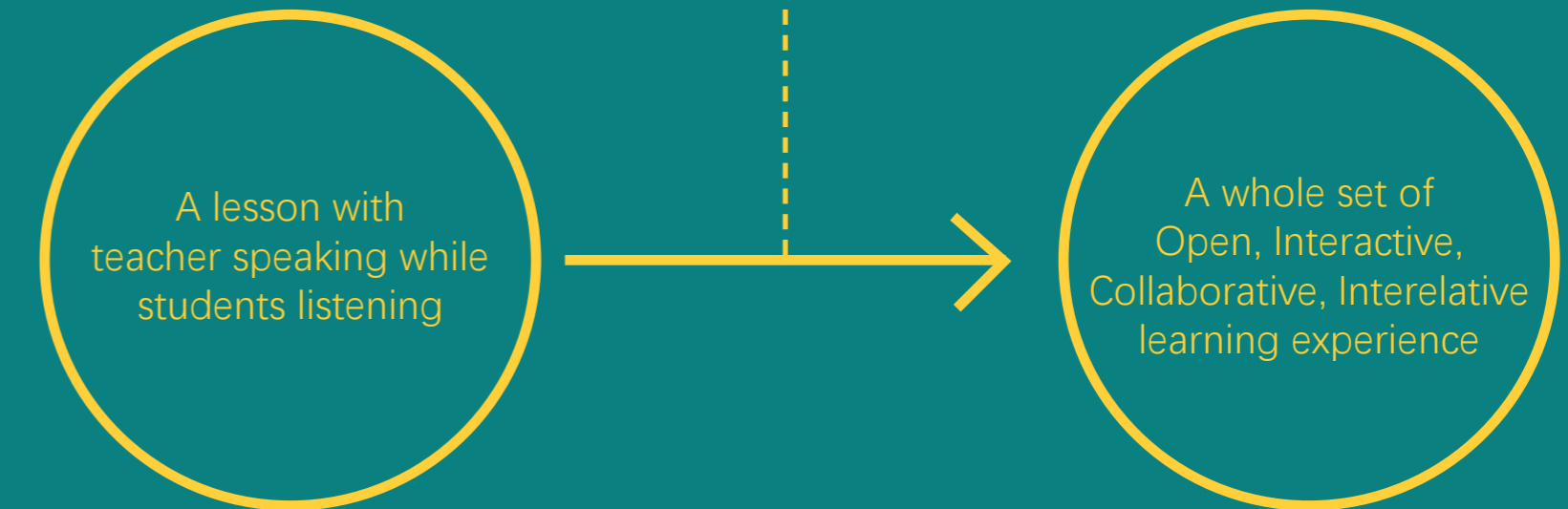
In the process of communication with the outside campus system, the framework structure of the open knowledge library can be used in the knowledge organization of the online website or WeChat public platform to promote the external output of sustainable knowledge.

To sum up, the establishment of open knowledge library helps learners to acquire the existing explicit knowledge in the learning community, and then to complete the implicit individual knowledge and the construction

Conclusion

Apply Service Design in Learning Experience

The **Integration** of Knowledge Product Service System Involved in Teaching Activities **from the Perspective of Service Design**



Conclusion

Apply Service Design in Learning Experience

Design is closely related to human material resources, water, energy, climate change, food production, natural systems, etc., and will have a wide and profound impact on it through everything designed. The global ecological crisis has brought new challenges to design and design education. For the common benefit of mankind, sustainability should be an important part of design education and design industry. As future designers, design students need to understand sustainable issues related to design through relevant teaching activities and have the knowledge and ability to solve these problems with design. As a creative, user-centered, whole-process and holistic approach, service design can bring a new perspective to the teaching, research and design of sustainable design. Therefore, this study USES the service design method, based on the real case of "Sustainability Design Consciousness" course in the school of design and creativity of Tongji University, to explore how to improve the knowledge product service system of "Sustainability Design Consciousness" course, so as to enhance the learning experience of learners and promote the collaborative construction of knowledge in the learning community.

In order to study the design of knowledge content and service form of knowledge product service system, the author USES literature research method to carry out theoretical research. In the aspect of knowledge content, this paper discusses two closely related knowledge abilities which are very important to the teaching of sustainable consciousness, that is, Holistic Perception and Ecological Literacy. Then, based on the teaching of the concept of sustainable design, the connotation of sustainable design is discussed based on the fact that design not only causes environmental crisis, but also has the ability to solve problems. From the perspective of teaching content, it is pointed out that compared with the study of specific technical methods, the cultivation of Sustainability Design Consciousness based on the thinking mode of

Holistic Perception and basic cognition of Ecological Literacy is of more long-term significance for students majoring in design.

In the process of knowledge construction, learners need to establish a continuous and effective transformation mechanism of explicit and tacit knowledge so as to improve the knowledge system. In the context of group teaching, students collaborate with each other to create and improve their existing knowledge. Therefore, the goal of teaching not only includes the acquisition of individual knowledge, but also is related to the knowledge refinement, innovation and development of common learners. In the process of knowledge construction, the establishment of dynamic Shared knowledge library is conducive to the promotion of collaborative and shared learning. In addition, the paper explores the life cycle of knowledge in teaching context and the process of knowledge transformation in each stage. Therefore, in the form of service, the knowledge product service system needs to provide a service mechanism that supports collaboration and communication, and establish an open knowledge library where possible, so as to extend the life cycle of knowledge in the process of knowledge service.

In the case analysis of the course of "Sustainability Design Consciousness", the author uses the knowledge-related theories and service design tools, integrated knowledge service ecological map, user journey map based on knowledge life cycle and other research tools to comb and analyze the knowledge product service system. In addition, three user research methods, namely interview, questionnaire survey and observation, were used to obtain a large amount of first-hand information to analyze users' pain points and needs. It is found that the curriculum of "Sustainability Design Consciousness" has various forms of knowledge products and services, the curriculum content is well integrated with systematic thinking and Ecological Literacy, and the teaching activities have various transformation mechanisms of explicit

Conclusion

Apply Service Design in Learning Experience

and tacit knowledge, but the knowledge construction in the learning community is not obvious. The course has a variety of stakeholders, among which the participation of sustainable followers is low, the knowledge input from the system is too complex, the knowledge output from the system is limited, the form is research-based, and the social value needs to be explored. The life cycle of curriculum knowledge has the potential of prolonging, and more opportunities should be created in the innovation of knowledge utilization. The main service touch points of the course are lectures, assignments and research projects. Based on the research results from various angles, the design opportunities for improving the original service system are summarized.

Finally, the author uses the level of service innovation to sort out the user needs and design opportunities obtained from the case analysis, and put forward the expression form of the open knowledge library and the design of the use scenarios, as well as the design improvement strategy of self-teaching/learning class, toolkit for assignment, and open forum/exhibition.

In this paper, the characteristics of the study is to try to use the perspective of service design to research of sustainable design teaching activities, the introduction of the design of ecological system, the user service journey and user-centered, etc., through the use of service design theory and tools, mining knowledge product potential and the defects existing in the service system. The traditional means of teaching and research, however, are usually only from the Angle of the top-down approach or one-way linear to analyze and design the teaching process, and thus ignore the user's experience, knowledge from access to update the overall process and iteration cycle, teaching activities related to knowledge service is of greater value, and a greater level of collaboration and resource integration. When designers involved in teaching activities with service design after the combination of the

knowledge of product service system, balance the flow of knowledge from the system level, prolong the lifecycle of the knowledge on the journey of the user to promote iterative loops and the generation of new knowledge, based on students' feedback to design service touch point, make sustainable knowledge teaching activity is no longer only teachers tell students to listen to lesson, but transformed into a set of open collaboration of interactive communication related learning experience. The greatest significance of this study is to participate in the research and design of teaching activities as a service designer, to try to integrate resources more effectively and to provide an overall student-centered service experience.

Vision

Paradigms Change in Design Education

In the urgent reality of the **global ecological crisis**, design education must achieve **paradigms change**.



Vision

Paradigms Change in Design Education

During the research and design process, the author found that a knowledge-based product service system for design students with a sustainable theme requires the joint efforts of all student-related system participants. In other words, only a short 36-hour course The curriculum does not effectively enable design majors to acquire the knowledge and ability related to sustainable design.

In interviews with industrial design students, the author learned. Students will watch some sustainability-related documentaries in the first grade design introduction class; they will learn about materials and processing technology in the second grade design technology class, but they do not emphasize the impact of the choice of materials and processes on the environment; in design projects Instructors will have sustainability requirements, but the reality is that when sustainability requirements are put together with many other design requirements, they cannot be implemented well. Students at most use sustainable materials or modular design as an entry point for design, and do not assess the environmental impact of the design from the full life cycle; in addition, the school provides public experts lectures related to sustainability from time to time. Focus on case sharing. It can be seen that students can obtain some knowledge related to sustainable design in other courses and teaching activities, but the college does not provide students with the complete knowledge product service system support needed to build a sustainable knowledge service system.

Therefore, the author believes that the "Sustainable Design Concept" course as part of it can provide students with basic theoretical knowledge and research methods, while other courses or teaching activities should be based on sustainable design methods, sustainable evaluation of design results and Continuous design case studies and other aspects to achieve in-depth learning and expansion of knowledge, each part of which supports and complements each other, constitute a sustainable

knowledge system, in order to more effectively cultivate the sustainability awareness of design majors.

Constructing an overall sustainable design knowledge service ecosystem requires holistic planning and design at a higher system level, and also involves the collaboration of more students, teachers, and teaching managers and other stakeholders. However, organizational transformation that touches the deep hypotheses of the organization often faces tremendous resistance. Under the urgent reality of the global ecological crisis, design education must achieve a paradigm shift. The design at the higher system level deserves more consideration and research. And in a system nested with each other, different levels of design have different design challenges, and higher-level design will bring a wider and far-reaching impact. For example, the design of a course, the association of multiple courses, the design of the curriculum system and the training plan of the college, the organizational cooperation between multiple colleges and even the global learning and research network. However, the author believes that the emphasis on service design is student-centered, and the focus on the overall and system associations will still be the key point to be considered in the organizational transformation at different levels.

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I Appendix

Transcripts of in-depth interviews with students of Sustainability Design Consciousness course in the fall semester of the 2018-2019 academic year

Interview A

Interview date: February 11, 2019

Place: Collage of Design and Innovation, Tongji University

Interviewee: YGH, student of Sustainability Design Consciousness course in fall 2018 semester

Main contents of the interview: cooperation with other students; Sharing and utilization of research project results

Q: When you were working on the hybrid car project, did any other groups discuss it? Let's say they're all air people/or they're all traffic people

A: There wasn't.

Q: Will you be looking at the assignments uploaded by other students at Teambition

A: Will the

Q: From what psychology

A: First there must be some performance considerations, look at the other classmates about the completion of the degree, after all, even if we know where is the question, want to always have a lot of time to raise the cost of, on the other hand also is to have some kind of learning, such as graphic, other groups of students is a process, how to say how explains some indicators as colloquialism, as well as the layout

Q: Will that focus on other groups of content

A: In terms of the content, I think it is necessary to understand the above no matter for any reason, otherwise it is difficult to judge whether the other group is clear, or the specific completion degree

Q: Do you have any other groups that impressed you

A: The air purifier, the data center, the toilet paper, and the final score should also overlap

Q: Do you think that the topic of "food, clothing, housing, mobility, waste" and the division of labor of "water and land gas" have helped you

to develop some cooperation within the class

A: I think our group might see from side, to provide for "abandon" less help, because we are doing this "typical" this level of feeling the "line" of this theme is not much, I'm not sure of other groups, "water and land gas" personally, I feel or have the potential of cooperation within the class but we also didn't and other groups

Q: So if there were more other groups doing traffic studies, would you feel more likely to communicate across groups?

A: I think it's still possible, for example, to have some global data, which we had a hard time finding, like the total amount of oil consumed by motor vehicles in the country, and I think if there were other groups we would have to do the same thing, right

Q: So, did you see the "do it" project last time

A: Yes, but not much. I remember taking a look at it and feeling it was quite different

Q: Well, in terms of homework, do you think the requirement of quantitative analysis makes sense, or do you think qualitative analysis is enough

A: I think this to see the topic of the bar, our words or necessary

Q: There are also some questions about intra-group cooperation. As a group that has been successful in integration, how do you three carry out division of labor and cooperation

A: As for the division of labor, since it is the general direction of the topic I decided, and I also know a lot about hybrid vehicles, I have done a lot of previous principle explanation. CMS searched a lot of literature related to LCA, and then he did a lot of statistical analysis of the data, including homogenization, standardization, etc.; Then LCY is responsible for converting the data in digital form into some more intuitive expressions. Cooperate in every part of the discussion was still a lot of, the first topic is to discuss, because the specific do, and who is this kind of choice or more, and then later literature search when a lot of information can be

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exchanged, the principle, overall data, LCA and visual impact, many papers will cover various aspects of the above, and the design thinking of this section is also working together, and then typesetting side everyone points to the beginning, do their own figure, I finally to integrate.

I feel that the visual style of our drawings and charts is quite different this time, and we didn't set a color standard at the beginning.

Q: When you are looking for data, do you always look in the paper or is there a more friendly data platform

A: It was mainly a paper, but the LCA standard adopted in the paper was also quite different, so CMS at that time was very painful to do, if one meter, there were more bugs, we used one meter for the oil part of the LCA, but in fact, they had to input a lot of data by themselves

Q: Well, there's still some tool support missing

A: Right, we were such as to find oil mobility during the impact on the environment, then we are all in one meter one we forecast of long transport distance, and then look at the impact on the data overall basic fall within the scope of error, so haven't go to see the accurate transportation distance, we were looking forward to is likely to be a one meter, I chose the oil, to the final dosage, one meter one can give to a full cycle of data, but still want us to fill in a lot of other data, these data may be to search for or calculated from other papers

Q: So maybe it's a good starting point for a designer to think about the full life cycle, but in practice it might be more feasible to work with an engineer or an expert in a related field

A: On the right

Q: Finally, I would like to talk about the sharing and utilization of research results. Do you think the final report was smooth at that time? Do you have enough time

A: We talk fast enough, but I don't think the teachers can accept the high information density

Q: Do you think that speaking slowly, like in the exhibition, will be

more conducive to your expression and the understanding of the audience

A: For the

Q: I wonder if it's possible to combine the presentation with the exhibition

A: I don't feel the scope, implementation difficulty is a little big, I can think of problem, for example, and exhibition, or any form of extended reporting time, may cause a report is not finished, that such things could be some unfair, such as the report in two weeks after the report of the students will have more time to prepare report, but may not have enough time to deal with feedback, and said if out of the projection, then see our content will become more difficult

Q: So do you have any better ideas

A: This is the place that compulsory course is awkward, how does person little all easy do, the word that person much is not easy do

Q: Two classes?

A: If the course arrangement will have to come over, I feel much better, so that students practice what should also be convenient for some, after all, junior, we should put this term design techniques on one day alone, is originally in the section with a professional design on the same day, equivalent to professional design in the morning, afternoon design technology, but to separate this year

Q: Then I opened it, and it went away for two days. Is that what it means

A: For the

Q: In other words, your project has just been sent to WeChat in the past two days. Do you think such sharing is meaningful

A: I don't think there are many people who read this kind of lengthy analysis on WeChat. Maybe zhihu column is a little better. On the one hand, the audience is suitable, on the other hand, the desktop web reading experience will be much better

Q: Would you like to know if you were asked to?

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A: You may worry that you're not good enough

Q: However, it does not mean that in such a relatively professional environment as Zhihu, further discussion is more likely

A: Actually, I think two credits is a bit much. Moreover, the topic selection of many students may not be able to develop into a topic that can be put into the portfolio. So utilitarianism, the students' will may be limited, right?

Q: Is the portfolio less put such research projects

A: Right, now that I think about it, I have a feeling that at the end of the day we're willing to do this sort of collation and publish it not necessarily as a record of how closely we expect others to read it but as a record of how much time we've invested in this course over the course of the semester, right? But now the trend I heard is to be able to start the article what, just I am not sure

Q: Do you think there is any possibility that such a study could go on to develop any design

A: Of course, each topic has the possibility of doing some visual communication or educational games, but the development of products or space design depends on the topic

Appendix

Transcripts of in-depth interviews with students of Sustainability Design Consciousness course in the fall semester of the 2018-2019 academic year

Interview B

Interview date: February 11, 2019

Place: Collage of Design and Innovation, Tongji University

Interviewee: WMX, student of Sustainability Design Consciousness course in fall 2018 semester

Main contents of the interview: cooperation with other students; Sharing and utilization of research project results; The study of sustainable design in other courses of industrial design major

Q: Do you pay attention to what people are saying when they report their homework before class?

A: What are people saying on the stage

Q: So will you be looking at the assignments uploaded by other students at Teambition

A: I will, because I think it must be reasonable for him to do a good job, and then I may want to know what is good, I will go to see the good homework Zhu said, to see the analysis of others

Q: That would be a direct interaction with other groups of students, like the air guys, the organic volatiles guys

A: Not quite ah, it may be because the study is really too busy, and then generally do not have so much time to communicate with each other, and in fact, if you really say it will not be really professional and academic communication, after all, we are also trying to search for information in small vain

Q: There won't be some methodological exchange in terms of data search

A: Actually, to be honest, there is not much, like I am really serious about this subject, but actually there are not too many teams that are really serious

Q: So basically every group is a group

A: I think it is about the same. In my own understanding, the weakness of our college is not as free as that of foreign colleges

Q: So back in your group how did the three of you work together on the purifier

A: If we actually be part of everyone's very clear, and will do in the beginning, organize the overall train of thought, the overall structure and logic, and then partitioned to do, is we are finally got the production consumption, consumption and recycling consumption to do, then each part is not equal, so finish my classmates went to be responsible for the other part, if which part goes wrong then the corresponding students to organize and update, if there is the adjustment of the overall train of thought and reducing can we discuss together again, together to consider some of the content arrangement, basic we are online contact is given priority to

Q: The division of labor and cooperation is very organized. Do you find any aspect of research particularly difficult

A: I think it is better to collect and organize the data, because I feel that a lot of data just can't be found, or found piecemeal, processing and use will find a lot of data is not unified

Q: Do you think this quantitative analysis makes sense? Still think qualitative research is enough

A: I think it really depends on the problem. Maybe some problems still need to be quantitative, and a specific problem needs to be explained clearly by data, and it feels more convincing

Q: You've done this in other classes

A: There are a few specific topics, and the rest are basically, you know, a lack of this type of training

Q: Well, let's talk about the sharing and utilization of research results. WeChat recently pushed your project. Do you think it makes sense

A: Yes, this is a kind of record, also convenient to spread, and as a research report, also hope to influence more people

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Transcripts of in-depth interviews with students of Sustainability Design Consciousness course in the fall semester of the 2018-2019 academic year

Q: Well, you can think of other possible channels of transmission

A: Not yet

Q: Last question, do you think it is possible that the current research on purifiers will lead to some further design projects, whether you or other students will do them later

A: B: yes, I really want to continue doing it myself. Of course, it would be great if I could cooperate with others. Then it is my own little self can follow the teacher to continue to study the, the other is ok, because actually this kind of education is not much so I also hope to be able to continue to do, I personally admire, because our own resources at hand is not actually a lot, if you can find the focus of the research team or other colleges and universities support I think is really good, digression I actually because this class is also interested in design research, really my own itself is the school of arts living out, actually prefer to study class work, has been in the college do before just industrial design project, but have no chance

Q: Students majoring in design are really lacking in the cultivation of research ability

A: Right, because does not develop plan, actually is not to say the very serious research, even if is made of the research design itself is unsatisfactory, the understanding of the history of design and some limited, it is really difficult, yeah, the ability of research and reading is very important, college subject time too short can only produce fast pin design

Q: Well, it's all short and fast training, no in-depth research or design, that's all I want to ask so far, what else do you want to make fun of or suggest

A: It's almost gone. Actually, I like this class. Personally, I think it's kind of pioneering.

Q: So do you think sustainability awareness has really improved

A: Some, life or pretty influential, life in the details of what

Q: And then when we do the design

A: Yes, but maybe if it is applied to the design, it needs more

knowledge reserve, after all, it needs more efforts to be integrated into a problem solving thing

Q: By the way, are you also a designer? In other workshops, did you talk about the full life cycle of the product, or was there sustainability in the design? Because I remember our situation at that time is that in my sophomore year, in the course of design technology, teacher M talked about the characteristics and processing technology of various materials, but he did not emphasize the environmental impact. The rest seems to be gone.

A: For my work, ah yes, teacher M should have said it in the class, and then he used to watch some design documentaries, and he would mention some of them in a few words, but he did not focus on them completely. In fact, life cycle is usually mentioned in the design technology

Q: Did you watch the documentary together or on your own?

A: We watched it together. What class did we design? I can't even remember the freshman class

Q: When we were doing the design, there were no requirements in this respect

A: There are requirements, but you know that a lot of the requirements of design teachers are basically equal to saying, but in the end, there are not many students who can really value this, at most, some students will take new materials or sustainable materials as a design breakthrough point

Q: Or modular design or something

A: To be honest, the sustainability in China (our college) is just a key word to make the design look more comprehensive, but in fact, we all don't understand the system, and we don't know whether we can really recycle. It takes a lot of time to really consider this problem, so it is generally a concept

Q: Just rely on teacher Zhu a class really...Doesn't work

A: Is the master lead the door so, has been much better, this also look at people, have thought this will be good, and in fact, I personally think this

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Transcripts of in-depth interviews with students of Sustainability Design Consciousness course in the fall semester of the 2018-2019 academic year

is also related to the college, only for a very short introductory course, still can not drive students, but I think there is still a prospect

Q: It's nice of you to think so. I wish so

A: After all, this thing will be taken seriously sooner or later. I think a lot of sustainable design today will raise the price because of the design, and the result is that sustainability becomes a design added value

Q: The truth like Freitag

A: Yeah, it's a mixed blessing, but it still feels misleading

Appendix

Preliminary interview records of students in the course of Sustainability Design Consciousness in the fall semester of the 2018-2019 academic year

Interview time: November 7-13, 2018 (one week after the end of the course)

Place: Collage of Design and Innovation, Tongji University

Interviewee: 11 students who took a course on Sustainability Design Consciousness in the fall semester of 2018

Main contents of the interview: the relationship between courses and majors; Positive and negative feedback to the course; Changes in understanding of the concept of sustainability through the course; The impact of the course on future life, study, design and work

----- **Interview 1**

T: what's your major, please?

L: environmental design

T: do you think this course is relevant to your major?

L: very relevant

T: what do you think is the positive feedback from this course?

L: the classes and lectures have broadened my horizon and increased my responsibility for design. More importantly, I have systematically looked at the relationship between man and the earth. I have learned a lot from videos and field visits.

T: is there a negative side?

L: please control the time of the class

T: how has your understanding of the concept of sustainability changed over the course of this course?

L: it's more systematic and starts with the little things around you.

T: has this course had any impact on your future life, study, design and work?

L: I have some

Interview 2

T: what's your major?

M: environmental design

T: how do you think this course is related to your major?

M: close contact

T: can you talk about the positive impact this course has had on you?

M: personally, I think the information of the lecture is more effective, more focused and actually absorbed, which is impressive

T: what about the negative effects? This will help us improve on the bad things.

M: the amount of homework is a little bit too much, but maybe because we have too much time for specialized courses in the environmental direction; it is difficult for us to devote more time to the homework of this course.

T: how has your understanding of the concept of sustainability changed over the course of this course?

M: not just stay in the environmental protection or litter, air pollution on the concept of the large, empty, began to realize that in fact in many design method in order to solve the problem will cause more problems than it might, therefore in the process of design need to think about the scope of the need to understand the pros and cons of behind it in the first place, rather than simply begin to "solve" problems directly

T: has this course had any impact on your future life, study, design and work?

M: the most immediate effect may be to have an eye to see how unsustainable various things are around. It may also change some living habits and add "sustainable" thinking to the design, which is different from before

Interview 3

T: what's your major, please?

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L: environmental design

T: how do you think this course is related to your major?

L: not really

T: can you talk about the positive feedback of this course?

L: the lectures are of high quality, rich in resources and useful

T: please describe your negative feedback on this course to help us improve.

L: the final big study has a sense of formality and will spend a lot of time learning about things that might not be useful to us, like chemistry

T: how has your understanding of sustainability changed through the study?

L: I thought anyone could make a contribution to this, but now I think it's still a matter of law, system, production and processing

T: has this course had any impact on your future life, study, design and work?

L: it makes me more convinced of the power of profession and the importance of ability over consciousness

Interview 4

T: what's your major, please?

L: industrial design

T: do you think this course is related to your major?

L: yes, there is

T: can you talk about the positive effects of this course?

L: the books you read and the films you watch are very enlightening. The homework is uploaded to the public Internet disk to make the information open and transparent so that students can learn from each other

T: what about the negative effects?

L: delay; Too much homework; The classroom teaching is dull, the courseware information is multifarious;

T: how has your understanding of the concept of sustainability changed

over the course of this course?

L: think about sustainability in a system, not point-to-point impact

T: has this course had any impact on your future life, study, design and work?

L: biological systems are closely related to natural systems, and people should conform to the way natural systems work, where they come from and where they return to. Design also considers problems within the system, finding solutions that are beneficial to all

Interview 5

T: what is your major?

P: environmental design

T: do you think it has anything to do with your major?

P: a little

T: what do you think are the positive thoughts of this class?

P: it has influenced my views and ideas on ecological sustainability. From my own experience of garbage collection to studying and analyzing the food we eat every day, I've made a huge shift in my lifestyle and my sense of sustainability. At the same time, the requirements and recommendations of reading books can help me to understand the necessity and application of the sustainable model in the whole earth's ecology and personal life, and at the same time cultivate my ability and habit of reading English literature.

T: what about the negative ones?

P: but when it comes to specific research, I suffer a lot. I often get caught up in the confusion and self-denial about the impact of this issue on ecological sustainability, which leads me to spend a lot of time on the qualitative analysis of the problem. This is a characteristic of my own hesitation, but I hope to add small thinking exercises to the course, which will help us to form a sustainable and systematic thinking step by step. Such small piecemeal exercises are suitable for us to be busy with the

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homework of professional courses and have no time to pay attention to other courses. At the same time, through systematic choreography, we complete a whole training process, which will implicitly learn the way of systematic thinking. This approach is more effective than conveying a flow chart of systemic thinking.

Interview 6

T: what's your major?

W: industrial design

T: how do you think this course is related to your major?

W: close contact

T: please describe your positive feedback on the course

W: the concept of systematic thinking is the greatest achievement of this course. In teaching, the knowledge density is relatively high, so you won't feel sleepy, and the overall quality is also very high. The final research project task is larger than (normal), but it is beneficial.

T: what about negative feedback?

W: in my homework, I pay too much attention to information transmission.

In many cases, efficient communication takes more time than information collection and sorting, which I feel is the focus of this course. In the end, it's okay for a big assignment to be a presentation, but it's a bit of an inversion for a small assignment.

Interview 7

T: what's your major, please?

W: industrial design

T: how do you think this course is related to your major?

W: very little

T: please describe your positive feedback on the course

W: the class was very informative, the teaching assistant was responsible and understanding, Teambition was easy to hand in, the design research

was interesting, and I gained some new ways of thinking. Thank you

T: what about negative feedback?

W: 1. The class due to rich content so increasing blindly, finish, etc., affect the arrangement of the other class, hope to have more time concept 2. The final project report time is too tight, lead to can't express research results of 3. Good in general because after compulsory caused a lot of time on efficiency problem, personally think that this class is suitable for small and small number of in-depth study environment

Interview 8

T: what is your major?

R: environmental design

T: how do you think this course is related to your major?

R: closely related

T: please describe your positive feedback on the course

R: it's good for teachers to control their time and submit their homework before twelve o'clock. It's good to avoid staying up all night

T: what about the negative?

R: more sustainable cases can be introduced. Although it seems easy to do science, there is always a feeling of approaching science

Interviews 9

T: what's your major, please?

B: environmental design

T: do you think this course is related to your major?

B: closely related

T: please describe your positive feedback on the course

B: the content of the course is very comprehensive, especially revealing the interaction between different parts of the natural system. The content of the lecture made me understand the possibility of sustainable design from different perspectives.

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T: what about negative feedback

B: there is not enough individual/group help, especially when we do our homework, we are trying our best, which is very inefficient. At the same time, the books bought by each class may be collected and sold to the next class

T: how has your understanding of the concept of sustainability changed over the course of this course?

B: knowing the important role of production and consumption system in sustainable development,

T: has this course had any impact on your future life, study, design and work?

B: it gave me a chance to focus on learning and thinking about sustainability, and to read the books I wanted to read. A deeper understanding of sustainability may guide the way forward

Interviews 10

T: what's your major, please?

Y: industrial design

T: do you think this class is in line with your major?

Y: it doesn't matter

T: please say what you think is the positive feedback from this class

Y: we've seen a lot of videos about it, and we've learned a lot about it.

T: please describe your negative feedback on this course to help us improve

Y: the homework and the class are not closely related to the design. Even if they are, they are indirect, which leads to a lack of enthusiasm for learning

T: how has your understanding of the concept of sustainability changed over the course of this course?

Y: probably, many factors are related to each other, so the design should not be one-sided and the conceptual understanding should not be overturned

T: has this course had any impact on your future life, study, design and

work?

Y: not much, just a lot of knowledge.

Interviews 11

T: what is your major?

L: media communication design

T: what do you think of the relationship between this course and the major?

L: keep in touch

T: please describe your positive feedback on the course

L: 1. This is my first time on the specialized courses to learn how to scientific research, and it should be a kind of necessary ability 2. Plenty of learning materials, such as books, video resources, etc. 3. The high quality of the lecture (like the bionic lectures, lecture LCA is also very meaningful 4. Better cognitive ability to the cultivation of thinking ability, changed my previous for sustainable, environmental protection a lot of very one-sided understanding of these concepts 5. Living garbage life-food lines of the final project to project and is very close to the life, very suitable for everyone began to study and understand the sustainable design

T: what about negative feedback?

L: 1. The finish, finish will let you produce negative emotions. 2. Everyone can have different starting point design, can be to man himself, in order to people's lives better, pain was reduced, experience more comfortable and so on, can also is only for entertainment for fun, and so on, the starting point of different bring different values and design evaluation system. But it should be recognized in all values and evaluation systems that sustainability, as a designer's responsibility to the planet, can not only be a starting point for design, but also a yardstick of responsibility that should be considered by different designers.

So sustainable should be a compulsory course, and the sooner the better, preferably in a large (freshmen have open source don't bump into) or a

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sophomore, in what is everyone began to cognitive design efforts in the field of design, the design values of cultivating the sense of responsibility, when I was beginning to form rather than in junior people have formed their own a set of design concept (no matter good or bad, and many people are busy preparing for the university, to speak a little late, is not interested in or think to yourself after little classmates might not good reception.

3. Because the content of this course is more theoretical and academic, we may think about how to express it more vividly in addition to effective expression. Nature itself is closely related to us and we can empathize with nature. For example, I remember teacher Guo's lecture that fireflies are sad, beetles spend their whole lives climbing to the top of the desert, and so on. This kind of anthropomorphic emotional expression may be more likely to arouse people's resonance. Help the parent stay focused.

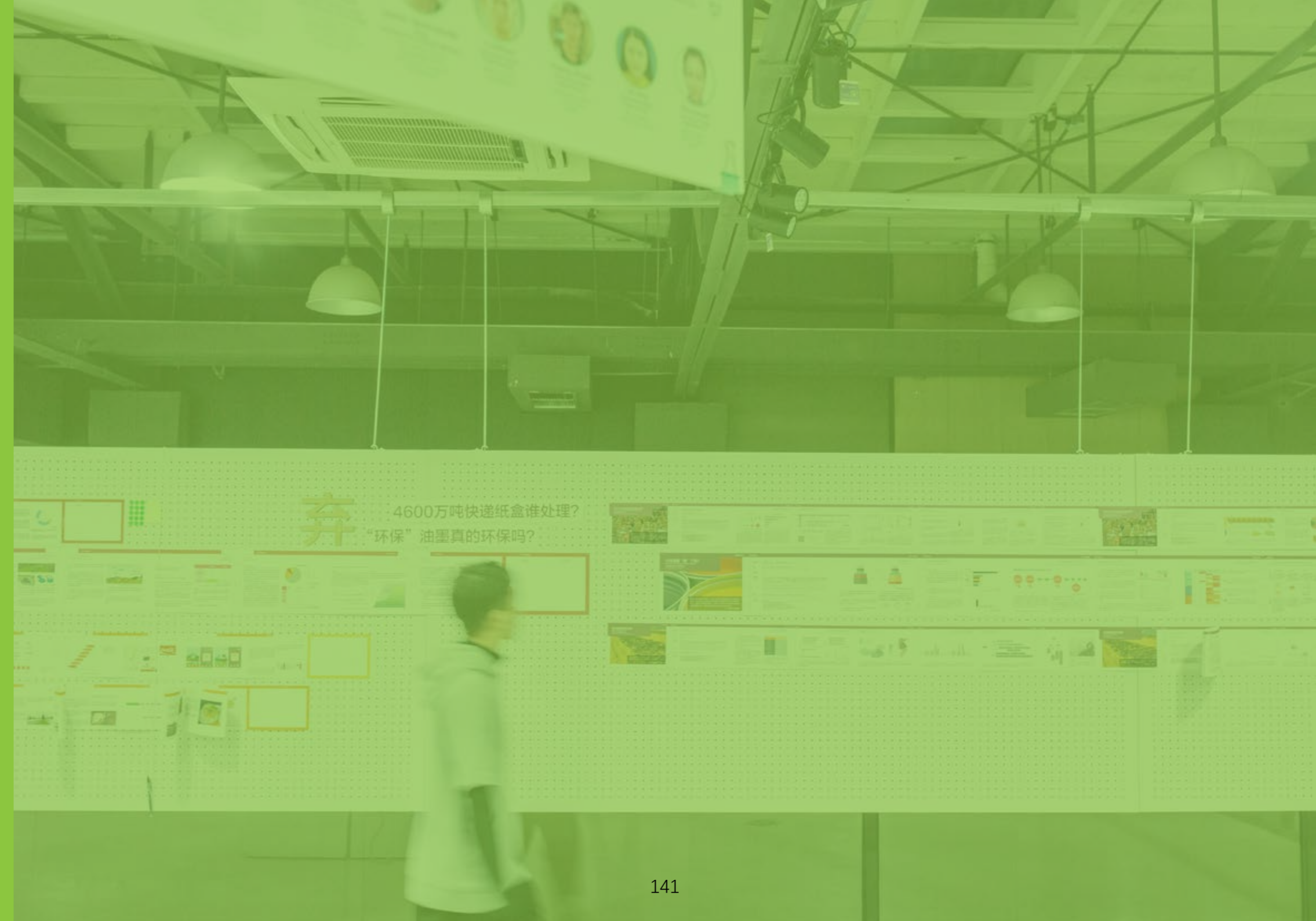
T: how has your understanding of the concept of sustainability changed over the course of this course?

L: 1. The whole life cycle has directly changed my judgment standard of the so-called environmental protection of many things.

2. Our air, water and even land are an integrated system, which will circulate and affect each other. Environmental problems are a global problem. I never knew what the city's sewage system was like, where it went under manhole covers, how the land could be contaminated, etc.

T: has this course had any impact on your future life, study, design and work?

L: yeah, and hopefully there will be a little bit more in the course (besides what we all know, what else can we do in our lives to be more environmentally friendly, and what are people doing in the sustainability field right now, that kind of sharing



不同视角下的 可持续议题

Sustainability Issues from
Different Perspectives



Made by TANG Runyu
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