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A FRAMEWORK FOR INTEGRATING SDGS INTO UNIVERSAL DESIGN EDUCATION IN CHINA

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ABSTRACT
Integrating the Sustainable Development Goals (SDGs) into design education and building up the knowledge base in this area is probably one of the most pressing tasks and challenges for Chinese design educators because of the increasingly serious issue of aging. Universal design, considered an effective tool for eliminating inequality and promoting social inclusiveness, is a suitable bridge for implementing SDGs into design education. It has the potential to help students appreciate user capabilities, needs, and expectations, and is increasingly important in mainstream design education. However, adopting SDGs in universal design education still meets many barriers in China. This study focuses on these barriers and tries to find possible corresponding actions based on a series of universal design workshops since 2017 at Shanghai Dianji University organized by the authors. Many research methods have been utilized, such as literature review, expert interview, and case study. Many influencing factors have been hypothesized and examined by questionnaire or interview, including major, grade, real user participation, icebreaker, tea break, variety of teaching places, etc. Through quantitative and qualitative analysis, some key factors are focused and put into discussion. Finally, a preliminary conceptual framework is proposed to embed all positive influencing factors to integrate SDGs into universal design education in China.

Keywords: SDGs, universal design, design education, China

1 INTRODUCTION
China is facing an enormous demographic shift. According to the latest statistical communiqué from the National Bureau of Statistics of China in 2023, the percentage of the population aged 60 and above will be 19.8%, and those aged 65 and above is 14.9% by 2022[1]. “With the occurrence of a rapidly aging population, the issue of universal access and inclusivity is a challenging and complex one” [2]. The SDGs were adopted at the UN Summit held in 2015, which have 17 goals with 169 targets, are designed to build a sustainable world under the motto of “No one will be left behind” [3]. There are various approaches to solving the challenges of SDGs, but in recent years, the power of universal design has been attracting attention. “Universal design” shall not exclude assistive devices for particular groups of persons with disabilities where this is needed” [4], was identified as a response to the issue of aging, has become a worldwide movement [5]. Universal design, which is defined by the United Nations Convention on the Rights of Persons with Disabilities as “the design of products, environments, programs, and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design [4]. SDGs have attracted widespread attention in Western countries, the key problem is how to transfer it to implement, and it is significant to develop and nurture a generation of aware and well-equipped young designers. However, it is crucial to integrate SDGs into design education. In China, there are many practices in recent years. A series of universal design workshops towards SDGs have been held since 2017 at Shanghai Dianji University. Similar workshops were held at Tongji University and Donghua University in 2018 and 2019. SDGs design international competition hosted by Kyushu University was introduced to China, and many Chinese university students participated in this competition and won awards.
Although a great deal of effort is made, there are still many challenges in China. For example, SDGs are seldom embedded in courses in the curriculum for undergraduate design education. The involvement

of real users with various capabilities loss is still limited by timetable or funds. In addition, SDGs approaches need to be translated into the Chinese context. Besides these, finding resources and tools to support SDGs in design education in Chinese is hard. There is no ready teaching textbook in Chinese for the moment. The abovementioned phenomenon suggests that SDGs do not widely spread as we hoped in China. This paper tries to identify the barriers and limitations of integrating SDGs into China's universal design education. Corresponding strategies are suggested in the form of a conceptual model in the end.

2 METHODOLOGIES

At first, a literature review focused on SDGs and universal design education was carried out. The practices and perspectives from different countries are synthesized. Compared with the barriers to integrating SDGs into design education from the literature review, related to the author's experience in a series of universal design workshops towards SDGs at Shanghai Dianji University, preliminary barriers were initiated empirically, then demonstrated to expert interview.

The expert interview aims to get some perspectives and insights from interdisciplinary experts, especially from teaching administrators in the Chinese context. Nine experts were interviewed, and they are from these two areas:

- Design education (5 persons on product design, one from Tongji University, one from Donghua University, one from Kyushu University, and the others from Shanghai Dianji University)
- Teaching administration (4 persons from the teaching affairs office of Tongji University and Shanghai Dianji University, covering educational theories, teaching organization, and students' innovation projects administration)

The interview was face-to-face and open-minded, beginning with a free talk on China's education situation, aging problems, challenges, and opportunities. Then the topics moved to in-depth discussion on integrating SDGs into China's education system. A brief introduction of SDGs and universal design was given to the experts from teaching administration in advance. The preliminary barriers were brought forth and assessed. Perspectives from design education and teaching administration experts were absorbed and four aspects of barriers were finally clarified.

Three experts mentioned the effectiveness of the Double-Diamond Model (DDM) in short-term workshops on universal design education. DDM, according to the Design Council, is a visual representation of the design and innovation process. It's a simple way to describe the steps taken in any design and innovation project, irrespective of the methods and tools used [6]. A further case study of Shanghai Dianji University's universal design workshops which was based on DDM was carried out. The student questionnaire results also confirmed this teaching paradigm's positive significance. Based on these, a conceptual framework was outlined under the context of China.

3 LITERATURE REVIEW

A critical review focused on SDGs and universal design education was carried out. The literature review synthesized many practices and cases from different countries.

During the literature review, some perspectives from Western researchers about strategies and barriers of introducing inclusivity into design education were found [7], which can bring some insights for integrating SDGs into China's universal design education. It is summarized in table 1:

Table 1. Strategies and barriers to introducing SDGs into Universal Design education

Aspects	Perspectives
Strategies	To drive a socially inclusive agenda into the heart of a design college or university through the teachers, tutors, and professors, the people who are the core of design education and management.
	To work directly with the design students to engender a more inclusive approach in their design practice.
Barriers	Few design courses teach universal design as a distinct unit and an introduction to the subject is often left to one or two seminars or lectures.
	Timetable demands mean that little time can be spent exploring the core benefits and wider practice of universal design.
	Design is a time-pressured profession and teaches both the creative and the

	constructive elements of a design course can fill most of the available studio time.
	As design is a subject that requires the constant development of both personal taste and expression, therefore there are few opportunities to get inclusive thinking into an already packed curriculum.
	To drive a socially inclusive agenda into the heart of a design college or university through the teachers, tutors, and professors, the people who are the core of design education and management.

4 EXPERT INTERVIEW

Expert interviews provided information on the barriers from two aspects, one is from the angle of design education, and the other is from the angle of teaching administration. The perspectives are sorted out in table 2:

Table 2. Expert interview results

Aspects	Perspectives
Design education	Design education is sometimes less connected with the industry.
	Cannot find appropriate textbooks in Chinese.
	It's hard to find excellent teaching cases in China.
	It's difficult to adopt SDGs methodologies.
	Real user involvement may cause economics, administration, ethics, and other problems.
Teaching administration	Universities are likely more employment oriented.
	It's difficult to conduct interdisciplinary education because of the limitations of colleges and major divisions.
	Lack of flexibility of course system and class organization.

Based on interview results, the barriers to integrating SDGs into China's universal design education can be preliminarily catalogued into four aspects, and corresponding responses are initiated:

- Barrier: Lack of awareness

Response: Propaganda from different representatives and different levels

- Barrier: Lack of resources

Response: More resources and tools in Chinese

- Barrier: Practical difficulties

Response: More practice, training, and cases

- Barrier: Financial and cultural factors

Response: More funds and guidelines

In response to the barriers and responses, combined with the experts' suggestion to integrate SDGS through a workshop based on DDM, a case study was conducted to address the above issues. This case is based on financial support from the university, guided by the DDM model, and integrated SDGS through a universal workshop. Stakeholders from different fields have been attempted to be introduced, and various resources and tools have been provided. This case provides a good example and attracts public attention to SDGs through different occasions.

5 CASE STUDY

Towards the needs of aging society, the School of Design and Art of Shanghai Dianji University identifies service design and health design as the key development directions of the school's discipline. Under this context, with funding support from the university's "Distinguished Overseas Professor" project, the school invited the second author of this paper from Kyushu University and her assistants to hold a series of Universal Design Workshops since 2017 (summarized in Table 3). The workshops focus on the theme of SDGs and mainly aim to provide proposals for the design challenges of China's aging society in the future. Workshops are offered during the university's summer short semester and organized teaching based on DDM. Over 4 to 5 days, students discover design problems through social research and user interviews, brainstorm design solutions, create product prototypes through prototyping, and continuously iterate and optimize to ultimately produce the best design solution.

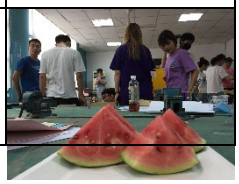
Table 3. Universal Design Workshops at Shanghai Dianji University

Year	2017	2018	2019	2023
Theme	Design Challenge for Aging Society 2030	Design Challenge for Aging Society 2030	Design Challenge for Chinese Future Aging Society	Sustainable Future Design for Children
Time	6.27-7.1 (5 days)	6.26-7.2 (5 days)	6.23-6.26 (4 days)	6.18-6.21 (4 days)
Students	×35	×37	×24, ×12	×20, ×13
Real users and stakeholders' participation	×6	×6	×6, ×3, ×3, ×2, ×5	/
Teaching place				
Others				

= undergraduate student on product design of grade 2; = undergraduate student on product design of grade 3; =undergraduate student on digital media design of grade 2; = undergraduate student on digital media design of grade 3; =real user; =nurse; =engineer; =international student; =other professional; =brainstorm room; =model workshop; =presentational hall; =icebreaker; =tea break; =final presentation

Each process of the workshop is recorded and photographed. The outcome of student works generally includes PPTs, physical models, and demonstration videos. Students are required to complete qualitative and quantitative questionnaires before and after the workshop and write their feedback on the commemorative book. All these materials have been carefully organized for further analysis. Through vertical comparative analysis of workshop student learning outcomes and student evaluations, as well as horizontal comparative analysis with similar workshops and courses at Shanghai Dianji University, some factors that can have a positive impact on student learning outcomes and experiences have been selected, they were summarized in Tabe 4:

Table 4. Positive influencing factors in the workshops

Influencing factors	Implementation status	On-site photos
Real user involvement	Old volunteers as real users were invited to join each student team, give their insights or advice, evaluate design solutions, assist with the prototyping, and attend the final presentation during the workshop.	
Different stakeholders	Different stakeholders including nurses, engineers, and other professionals were invited to join student teams in the beginning of the workshop. Their professional opinions can help students understand the various factors that design schemes need to consider in the real world.	
Interdisciplinary collaboration	The later workshops attempted to build student teams across different majors and grades. Compared with the early student teams composed of a single major and grade, teams who cross major and grade exhibit higher learning enthusiasm, more active thinking, and better design outcomes.	
Icebreaker	The diverse icebreakers activities such as games, mini-competition, or outdoor activities, etc. provide students with a different experience from traditional classrooms. According to student questionnaires, they gave high evaluations to icebreaking activities, which enliven the classroom atmosphere and stimulate innovative thinking.	
Tea break	The students left a deep impression on the tea break during the interview. Although tea breaks are rare in traditional classrooms, they can alleviate stress and stimulate innovation for short-term high-intensity workshops.	

Variety teaching places	According to teaching requirements, the workshop's teaching place is constantly changing from classrooms suitable for lectures, and off-campus locations for social research, to brainstorm rooms for inspiring design proposals, model workshops for prototyping, to auditoriums for final presentation. The conversion of teaching places is more in line with the workshop's progress and promotes better student outcomes.	
Quick prototyping	Quick prototyping runs through the entire process of the workshop. Students were provided with various materials in the early stages of the workshop. They were encouraged to creatively use various items to make quick prototyping. In the later stages of the workshop, students entered professional model workshops to create more detailed physical models.	
Final presentation	The final presentation helps to create a sense of ceremony, and students can combine PPTs, physical models, and videos for comprehensive presentations, and even incorporate performances. The works of students were comprehensively evaluated by teachers and students, and outstanding teams were awarded on-site recognition.	

6 A CONCEPTUAL FRAMEWORK

This conceptual framework (Figure 1) is a proposal and still needs to be continuously improved in practice. It manages to accommodate all the positive influencing factors of integrating SDGs into China's universal design education based on DDM. From left to right are "two diamonds": the first diamond helps students understand, rather than simply assume, what the problem is. It involves speaking to and spending time with people who are affected by the issues. The insight gathered from the discovery phase can help students define the challenge differently; the second diamond encourages students to give different answers to the clearly defined problem, seeking inspiration from elsewhere and co-designing with a range of different people. Delivery involves testing out different solutions at a small scale, rejecting those that will not work, and improving the ones that will.

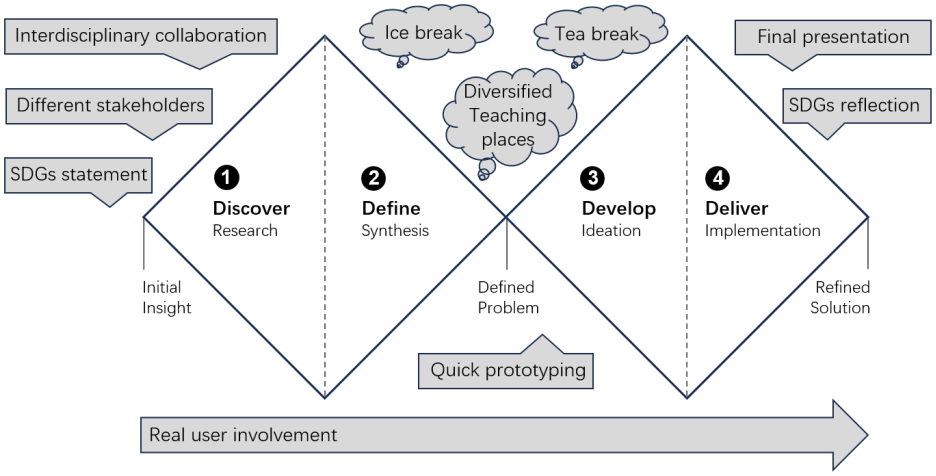


Figure 1. A Conceptual Framework for integrating SDGs into universal design education in China

During this process, the integration of SDGs into universal design education under the Chinese background has several positive factors. The timing for introducing these factors into DDM is shown in Figure 1. At the beginning is SDGs statement, the background, purpose, and significance of SDGs need to be introduced to students. At the start of the first diamond, students need to consider cross-disciplinary considerations when grouping. It is necessary to invite different stakeholders to join the team at this stage to provide various required information. Real users need to join the team from the beginning to

help students better understand the needs of special users. Real user participation needs to be implemented throughout the entire workshop process. During this period, considering the constraints of funds and energy, online participation can be partially adopted. Icebreakers can be dispersed in the workshop. In the early stages of the workshop, icebreakers can help students from different majors, stakeholders, and real users quickly familiarize themselves with each other and establish good teamwork relationships. In the middle of the workshop, when a task lasts for a period, it is possible to consider engaging in icebreaking activities, which can have a good relaxing effect and help to liven up the atmosphere, promoting divergent thinking. According to the needs of workshop teaching, it is necessary to find different optimal teaching places. There is a need for a learning place suitable for lectures, a place that helps with divergent thinking and the production of simple models, a place for making detailed prototyping, and a place for final presentations. If the furniture and layout in the classroom can be easily moved and assembled, some of these places can also be combined. Starting from the second diamond model, prototyping with different accuracies can be dispersed throughout the process. When discussing the initial plan, a simple model can be used to evaluate the plan. In improving the plan, making different prototyping can help optimize and iterate the plan. After determining the final plan, it is necessary to create a more refined model, which is usually completed in the model workshop. During the workshop, tea breaks can be provided, which can be distributed to teams or placed in designated areas of the classroom for students to enjoy. Finally, after students have completed all their work, a more formal presentation and display can be organized. Student teams will report and showcase their works one by one on stage, which will be evaluated by the teachers and students below. Outstanding works can be awarded certificates. At the end of the final presentation, the goals of SDGs need to be reviewed and reflected upon, and the social responsibility of designers should be emphasized.

7 CONCLUSION AND FUTURE WORK

The study focuses on integrating SDGs into China's universal design education, a literature review was conducted mainly among key publications on SDGs and universal design education. Practice and perspectives were synthesized and barriers to integrating SDGs into China's universal design education were initiated and judged through expert interviews. A case study was carried out to find the positive influencing factors. Then a preliminary framework based on DDM was generated. The framework suggests the likely route of integrating SDGs into China's universal design education. It shows the possibility of potential application for China's design educators.

However, the framework is primarily based on empirical study. More literature review and practice may take place in the future to improve this framework.

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REFERENCES

[1] National Bureau of Statistics of P. R. China. *Statistical Communique of P. R. China on the 2022 National Economic and Social Development*. Available: https://www.stats.gov.cn/sj/zxfb/202302/t20230228_1919011.html [Accessed on 2024, 1 March], (2024) 1 March.

[2] Macdonald A. S. The inclusive challenge: a multidisciplinary educational approach. In: *Designing accessible technology*, London, 2006, pp.3-12 (Springer-Verlag London, London).

[3] United Nations, Department of Economic and Social Affairs. *The 17 goals*. Available: https://sdgs.un.org/goals [Accessed on 2024, 1 March], (2024) 1 March.

[4] United Nations. *United Nations Convention on the Rights of Persons with Disabilities*. Available: https://www.un.org/esa/socdev/enable/rights/convtexte.htm [Accessed on 2024, 1 March], (2024) 1 March.

[5] Dong H., Clarkson J., Ahmed S. and Keates S. *Investigating perceptions of manufacturers and retailers to inclusive design, The Design Journal, vol.7, issue 3*, Abingdon, 2004, pp.3-15 (Taylor & Francis, Abingdon).

[6] Design Council. *The Double Diamond*. Available: https://www.designcouncil.org.uk/our-resources/the-double-diamond/ [Accessed on 2024, 1 March], (2024) 1 March.

[7] Gheerawo R. and Donahue J. Introducing user-centred design methods into design education. In: *Designing a more inclusive world*, London, 2004, pp.21-30 (Springer-Verlag London, London).