A Study on Chinese Fashion Design Students' Perceptions on Sustainable Practices Throughout the Lifecycle of Clothing Products

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Abstract

Fashion departments of higher education institutions currently play a decisive role in promoting sustainable development as centers of cultivating fashion design talents towards the rapid increase of environmental issues that caused by the fashion and textile industry. Through both quantitative and qualitative approaches, we aim to determine the perceptions of fashion design students regarding sustainability practices throughout the lifecycle of clothing products within the context of Chinese fashion design higher education in sustainability. An online survey is conducted to ascertain Chinese fashion design students' perceptions (due to their varied sustainable educational backgrounds), self-learning channels on sustainable practices throughout the lifecycle of clothing products, and open-ended questions related to sustainability knowledge application for 60 student participants from three Chinese universities with different statuses of sustainable education respectively (University A has constructed a sustainability related curriculum and has designed relevant design projects; University B has not constructed sustainability related curriculums, but has designed a relevant design project; University C has not constructed sustainability related curriculums and has not designed relevant design projects). Data analysis is conducted by using non-parametric test and Chi-square test. The findings show that, as compared to students from universities B and C, university A students showed significantly higher perception levels, used more self-learning channels with books and journals, and were able to apply relevant knowledge to fashion design more effectively. Therefore, the findings from this study will provide insights into educators' perceptions of integrating sustainability into higher education of fashion design in China.

Keywords: Fashion Design Higher Education in Sustainability, Student Perceptions, Sustainable Practices, Lifecycle of Clothing Products

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1. Introduction

As one of the largest textile manufacturers, consumers and exporters in the world (Hongyu, 2018), China has experienced a rapid increase in environmental issues caused by the fashion and textile industry (Zhang et al., 2020). China is now in urgent need of design talents to cope with the sustainable development of the fashion industry. Sustainable development could benefit from design talents shaping production practices and influencing consumption patterns (Hur & Cassidy, 2019). In such a context, fashion departments of higher education institutions are crucial in cultivating talents that contribute to sustainable development in the fashion industry (Yáñez et al., 2019). However, the development of sustainable fashion design education in Chinese universities is obstructed by a lack of fashion sustainability development curriculum, a disconnect between theoretical consciousness and practical action among educators, and the imperfection of relevant policies (Tao & Wang, 2020). Meanwhile, even though a large number of online and offline resources, including books, journals and newspapers, as well as websites, social media tools such as Sina Weibo, Bilibili, WeChat Official Account, and Tik Tok (Rahman & Chen, 2020), are available to students, fashion design students from universities still lack a systematic and comprehensive understanding of sustainable practice (Tao & Wang, 2020), resulting in many graduates being unable to find sustainable design jobs (Palomo-Lovinski et al., 2019). Although many Chinese educators' research involves the strategies of sustainable fashion design (Wang & Wang, 2018; Liu et al., 2019; Wu & He, 2004), limited research has been conducted regarding Chinese fashion design students' perceptions of sustainable practices. In the same way as China, many other countries are considering implementing sustainable education in higher education institutions (Ceulemans et al., 2015a; Lozano et al., 2015; Yáñez et al., 2019). This study explores the perceptions of Chinese fashion design students regarding sustainable practices throughout the lifecycle of clothing products, and it provides educators and education policy makers with insights into perceptions of integrating sustainability into higher education in fashion design. The specific research questions addressed in this study are:

RQ 1)   How is the comparison of Chinese fashion design students' perceptions on sustainable practices throughout the lifecycle of clothing products among universities with different status of fashion design higher education in sustainability?

RQ 2)   How is the comparison of the self-learning channels used by Chinese fashion design students for acquiring knowledge of sustainable practices throughout the lifecycle of clothing products?

2. Literature Review

2.1 The Current Status of Chinese Fashion Design Higher Education in Sustainability

According to statistics in 2021, there were 3012 higher education institutions (including undergraduate education institutions, junior college education institutions and adult education institutions) in China (GMW, 2022), and 1097 undergraduate institutions among them offered fashion design programs (creditsailing, 2022). Although there are no statistics regarding how many fashion design institutions have established sustainability curriculums, Tao and Wang (2020) and Liu et al. (2019) indicated that sustainability is still in its infancy in Chinese fashion design education. In the context of the rapid development of the social economy, the excessive consumption of resources and the deterioration of the environment (Liu et al., 2019), more and more fashion departments of Chinese higher education institutions are paying more attention to the sustainability of clothing products (Tao& Wang,

2020; Huang & Vicander, 2016; Yang, 2019). However, there are still many obstacles to the development of sustainable education in fashion design institutions, including a lack of fashion sustainable development curriculum construction, a disconnect between theoretical awareness and practical action among educators, and an imperfect policy framework (Tao & Wang, 2020). Similarly, Zheng and Zhang (2017) found that university faculty members prioritize research over teaching. Additionally, the complexity of clothing products throughout their lifecycles endows sustainability with multiple attributes in this field (Black, 2008; Koo & Ma, 2019) and enables higher education to face various challenges. In addition to China, many other countries are also exploring the full implementation of sustainable education in their higher education institutions (Ceulemans et al., 2015a; Lozano et al., 2015; Yáñez et al., 2019).

2.2 Sustainable Practices Throughout the Lifecycle of Clothing Products

As clothing products progress through their lifecycle, they pass through various stages including design, production (raw materials, fibres, and garments), distribution, consumption (procurement, use and maintenance) and end-of-life (Lou & Cao, 2019; Gwilt, 2014; Moorhouse & Moorhouse, 2017; Wiedemann et al., 2020). Each stage of the clothing lifecycle creates environmental impacts significantly (Lou & Cao, 2019).

Based on Gwilt (2014)'s model of garment life cycle and the previous studies (Fletcher, 2014; Lou & Cao, 2019; Khan & Islam, 2015; Hiller Connell & Kozar, 2012; Allwood, Laursen, de Rodriguez & Bocken, 2006; Goworek, 2011), the lifecycle of clothing products takes place in five main phases which are design, production, distribution, consumption and end-of-life. Table 1 shows the specific sustainable practices throughout the lifecycle of clothing product under each phase.

5 phases	Sustainable practices throughout the lifecycle of clothing product
Design	Design for zero waste
	Design for durability
	Design for multifunction, modularity and disassembly
	Design for empathy and well-being
Production	Low-impact materials and mono-materials use
	Organic/ recycle material use
	Restricted use of animal fur
	To control water use
	To control toxic chemical/ heavy metals use
	Efficient use of materials and resources
	Ethical and fair-trade production
	Environmentally friendly printing and dyeing
Distribution	Service for need
	To minimize transportation
	To reduce/re-use packaging
	To engage local communities

Consumption	Rational purchase
	To purchase second-hand clothing products
	Efficient garment use and to avoid waste
	To reduce/re-use packaging during use phase
	Appropriate care
	To control water use for laundry/ electricity use for drying
End-of-life	To repair a garment when it has an issue
	Re-use/recycling/ upcycling/ remanufacturing
	To dispose unwanted clothing through appropriate approaches

Table 1: Sustainable practices throughout the lifecycle of clothing product
under 5 main phases

3. Method

3.1 Data collection

This study utilizes both quantitative and qualitative approaches to ensure a specific investigation of the current perceptions of Chinese fashion design students toward sustainable practices in fashion design (SPIFD). In July 2022, the period of the end of an academic year, sixty fashion design student participants in their third and fourth year participated in an anonymous online survey. Table 2 shows the demographic information of the student participants. Students were informed that their responses would be used in research and that they could withdraw their individual data from the study. Apart from demographic questions, a five-point Likert scale was used to measure respondents' level of perception of each item (statement) relating to sustainable practices throughout the 5-stage lifecycle of clothing products based on Table 1. Answers ranged from one indicating 'strongly disagree' to five indicating 'strongly agree'. In order to determine the current status of self-learning channels and potential differences among student participants from three universities, multiple choice questions were also conducted regarding books, journals, newspapers, TV programs, websites, and social media tools. At the end of the questionnaire, we conducted two open-ended questions: 1) How do you apply sustainability knowledge to fashion design as a designer? 2) How do you apply sustainability knowledge to clothing usage as a consumer?"

Despite the three universities' location in northern China, they have different approaches to sustainable fashion design in their curriculums. University A has established option course related to SPIFD, and has created sustainable fashion design projects (SFDPs) in the core courses for second-year and third-year students. University B has not established any courses related to SPIFD, but has created a clothing upcycling project for the third-year students. University C has not established any courses related to SPIFD and has not created any SFDPs in courses.

		Number	Percentage (%)
Gender	Male	16	26.7
	Female	44	73.3
University Groups	University A	20	33.3
	University B	20	33.3
	University C	20	33.3
Year	Three	30	50.0
	Four	30	50.0

Table 2: On the demographics of survey respondents

3.2 Date Analysis

Quantitative data from the survey were analyzed using IBM SPSS (Version 28). It is appropriate to use non-parametric tests to compare students' perceptions between three universities when the data are not normally distributed (Foster, 1998). Meanwhile, Chi-square test is used to examine the comparison of learning channels used by Chinese fashion design students for acquiring knowledge of sustainable practices throughout the lifecycle of clothing products among three universities.

4. Results

4.1 Quantitative results

4.1.1 Validity and Reliability

A reliability test has shown that Cronbach's Alpha value is 0.958 (above 0.70), which is acceptable. The KMO measure of sampling adequacy is 0.837, and Chi-square value of Bartlett's sphericity test was 1353.862 ($p<0.01$), indicating a good relationship between the items of the scale.

4.1.2 The comparison of Chinese fashion design students' perceptions on sustainable practices throughout the lifecycle of clothing products among three universities

Non-parametric test is used to compare students' perceptions on sustainable practices throughout the lifecycle of clothing products among three universities. Kruskal Wallis test was administered to determine whether Chinese fashion design students' perceptions differ across three universities based on the mean value of students' agreement on each item at each stage of the lifecycle. As shown in Table 3, students' perceptions are significantly different among three universities. University A had the highest level of perceptions whereas University C had the lowest level (except at the end-of-life phase). Therefore, the Mann-Whitney U test with a Bonferroni correction for pairwise group comparison was used to determine the specific differences among three universities. As shown in Table 4, significant differences were found between university A and B as well as university A and C in terms of the stages of design, production, distribution, consumption and end-of-life. Accordingly, at all five stages, university A had a higher perception level than universities B and C respectively. In addition, no differences were found between university C and university B at any of the five stages.

Variable	*P*	*H*	University A	Mean rank University B	University C
Design	<0.001	23.360	45.68	24.93	20.90
Production	<0.001	24.102	46.13	22.73	22.65
Distribution	<0.001	18.643	44.18	24.23	23.10
Consumption	<0.001	15.314	42.90	24.95	23.65
End-of-life	<0.001	15.113	42.58	22.83	26.10

Table 3: Students' perceptions of sustainability throughout
the five-stage lifecycle of universities

Phase	Group	Median 50 (25, 75)
Design	University A	4.50 (4.00, 4.75) [a]
	University B	3.50 (2.31, 3.94) [b]
	University C	3.25 (2.50, 3.50) [b]
Production	University A	4.50 (4.16, 4.75) [a]
	University B	3.82 (2.31, 4.10) [b]
	University C	3.57 (3.03, 4.00) [b]
Distribution	University A	4.50 (4.00, 5.00) [a]
	University B	3.38 (2.81, 4.19) [b]
	University C	3.50 (3.00, 3.94) [b]
Consumption	University A	4.42 (4.00, 5.00) [a]
	University B	3.83 (2.67, 4.17) [b]
	University C	3.50 (3.00, 4.00) [b]
End-of-life	University A	4.84 (4.33, 5.00) [a]
	University B	3.67 (3.00, 4.33) [b]
	University C	3.88 (3.17, 4.59) [b]

Table 4: The differences in students' perceptions of sustainability throughout
the five-stage lifecycle among universities A, B and C

Note: Each subscript letter denotes a subset of one stage of lifecycle which do not differ significantly
from each other at the 0.05 level.

4.1.3 The comparison of the self-learning channels used by Chinese fashion design students for acquiring knowledge of sustainable practices throughout the lifecycle of clothing products among three universities

A Chi-square test was conducted to test the comparison of the self-learning channels for acquiring knowledge of sustainable practices throughout the lifecycle of clothing products among three universities. The self-learning channels of books and journals show significant differences among the three universities.

First, the results indicated a significant difference between the students from three universities in the self-learning channel of books for acquiring knowledge of sustainable practices throughout the lifecycle of clothing products (Chi-square = 9.617, P < 0.01). In the

following step, the Bonferroni test was used for pairwise comparison. As shown in Table 5, significant differences were found between university A and B on the self-learning channel of books, which indicates that students at university A choose books as their self-learning channels for acquiring sustainable practices is significantly more than students at university B; significant differences were also found between university A and C on the self-learning channel of books, which indicates that students at university A choose books as their self-learning channels for acquiring knowledge of sustainable practices is significantly more than students at university C. In addition, no differences were found between university C and university B on self-learning channel of books.

	Books			
	Yes	**No**	**Chi-square**	***P***
University A	18_a 47.4%	2_a 9.1%		
University B	11_b 28.9%	9_b 40.9%	9.617	0.008
University C	9_b 23.7%	11_b 50.0%		

Table 5: Chi-square test on the self-learning channel of books

Note: Each subscript letter denotes a subset of Books categories whose column proportions do not differ significantly from each other at the 0.05 level.

Second, the results indicated a significant difference between the students from three universities in the self-learning channel of journals for acquiring knowledge of sustainable practices throughout the lifecycle of clothing products (Chi-square = 12.480, P < 0.01). In the following step, the Bonferroni test was used for pairwise comparison. As shown in Table 6, significant differences were found between university A and B on the self-learning channel of journals, which indicates that students at university A choose journals as their self-learning channels for acquiring knowledge of sustainable practices is significantly more than students at university B; significant differences were also found between university A and C on the self-learning channel of journals, which indicates that students at university A choose journals as their self-learning channels for acquiring knowledge of sustainable practices is significantly more than students at university C. In addition, no differences were found between university C and university B on self-learning channel of journals.

	Journals			
	Yes	**No**	**Chi-square**	***P***
University A	18_a 51.4%	2_a 8.0%		
University B	9_b 25.7%	11_b 44.0%	12.480	0.002
University C	8_b 22.9%	12_b 48.0%		

Table 6: Chi-square test on the learning channel of journals

Note: Each subscript letter denotes a subset of Journals categories whose column proportions do not differ significantly from each other at the 0.05 level.

4.2 Qualitative results

Student respondents answered two open-ended questions in the survey: how do they apply sustainability knowledge to fashion design as a designer, how do you apply sustainability knowledge to clothing usage as a consumer. Since open-ended questions were not mandatory, eight respondents chose not to answer them. Among the 52 responses, for sustainable knowledge in clothing design application, most of the responses focused on up-cycling design with old materials, and few responses involved plant dyeing, multi-functional design, zero-waste pattern cutting, specific sustainable fabric use. Meanwhile, most respondents mentioned that they applied sustainable knowledge to clothing usage by reducing the amount of clothing purchase and disposing of unwanted clothing by donating, reselling, and using recycling boxes, and few pointed out how laundry can be used to reduce resource consumption, reuse clothing packaging, repurpose unwanted clothing, limit fast fashion brand items, and avoid animal fur or leather. In the responses to sustainable knowledge in clothing design application, students from university A provided more specific answers with professional terms: *'I have used recycled PET material, organic cotton and organic linen in my design collections'* (A_resp12). *'With Chinese knot buttons replacing resin buttons and zippers, the garment is particularly easy to dispose of with mono-materials'* (A_resp18). One response from university A also applied a design concept of environmental protection: *'I created the concept of harmonious coexistence between human and nature for my design collection, which advocated environmental protection through slogan elements, nature materials, and simple shapes'* (A_resp 04). Meanwhile, those from universities B and C provided less-specific answers, *'I have rebuilt a new garment with an old garment'* (B_resp 09) *and 'I reuse fabric'* (C_resp 16). In addition, one student from University B provided incorrect information: *'I use natural fabric as a sustainable material to replace chemical fiber fabric'* (B_resp 19). In terms of sustainable knowledge in clothing use applications, all three universities provided unique answers, such as: *'I collect and reuse clothing packaging and reuse them' (A_resp 05). 'I wash the dark and light color clothing items separately, and wash the wool items by hand at low temperature and lay them flat to dry'* (B_resp 04). *'I use cloth bags instead of leather bags, and I never use animal leather products'* (C_resp 11).

5. Discussion

Based on the results of the non-parametric test, there are significant differences in three-university students' perceptions of sustainable practices throughout the lifecycle of clothing products. First, the perception level of university A was significantly higher than the perception level of university C at all five stages, which indicated that compared with the university that had not established curriculum on SPIFD and had not created SFDPs, the university had established curriculum on SPIFD and created SFDPs which could significantly improve the perception of sustainable practices throughout the lifecycle of clothing products among students. Second, the perception level of university A was significantly higher than the perception level of universities B at all five stages, which indicated that, compared with the university that had not established curriculum on SPIFD but had created one sustainable fashion design project, the university had established curriculum on SPIFD and created SFDPs which could significantly improve the perception of sustainable practices throughout the lifecycle of clothing products among students. Third, university B, however, did not have a higher perception level than university C at all five stages. This indicates that the university didn't succeed in improving students' perception of sustainable practices even though it had created one sustainable fashion design project when compared with the university with a curriculum and multiple projects. Therefore, the primary educational responsibility of fashion

departments of higher education institutions is to develop curriculum on SPIFD to promote student perception. Although SFDPs could have a relative impact on promoting students' perception of specific sustainable practices, a curriculum is required to improve students' perception as basic support, since SFDPs aim to cultivate students' capability to apply knowledge of certain sustainable practices at specific stages of the entire lifecycle of clothing products. Holistic comprehensiveness of sustainable practices throughout the entire lifecycle of clothing products cannot be achieved by creating SFDPs alone.

The results of Chi-square indicate that among the six types of self-learning channels for acquiring knowledge of sustainable practices throughout the lifecycle of clothing products, students from three universities showed significant differences in books and journals, while newspapers, TV programs, websites, and social media tools did not show significant differences. Students at university A used significantly more self-learning channels of books and journals than students at university B and C. This could be interpreted as newspapers, TV programs, websites, and social media tools serve as common self-learning channels for students at all the three universities, while books and journals serve as significant self-learning channels for universities that have established curriculums and created SFDPs. As part of the curriculum or projects, reference books and journal articles would be provided, and students would be expected to read them when completing course components. Meanwhile, students at University B were not encouraged to read books or journals during their project, and they were probably more focused on developing practical skills.

According to the results of open-ended questions, students from three universities showed equal performance with both general and specific responses to the question regarding sustainable knowledge in clothing use applications (as consumers). When it comes to sustainable knowledge in fashion design applications (as designers), however, University A students performed relatively well with more specific answers using professional terms. Consequently, the relatively outstanding performance of students from University A with more specific answers with professional terms can be interpreted as showing that University A students have the ability to apply relevant knowledge through design through the study of curriculum and multiple projects. In contrast, students from University B and University C who did not take a curriculum and did not participate in multiple project studies were only able to understand non-specific sustainable design practices. Therefore, a curriculum and multiple projects were found to be important.

6. Conclusion

This exploratory study provides insights into the perceptions of Chinese fashion design students for educators and education policy makers on sustainable practices throughout the lifecycle of clothing products through comparing the perceptions of sustainable practices and self-learning channels of students at three universities with different statuses of fashion design. The findings show that, among students at the university who took courses related to SPIFD and projects, the perception level was significantly higher than those of students at the university who completed only one project without courses and those who did not take both c and projects together. Also, students at the university with both curriculum and projects used significantly more self-learning channels through books and journals than students at the university with a project but no courses as well as students without both courses and projects. Furthermore, students at the university with both a curriculum and projects are better able to utilize specific sustainable knowledge in fashion design than students without both courses and projects. Therefore, the primary educational responsibility of fashion departments of

higher education institutions is to develop curriculum on SPIFD to promote student perception. The multiple SFDPs could be created to support curriculum learning by cultivation of both practical skills and theoretical skills. Additionally, students should also be encouraged to read books or journals as part of their self-learning during courses and projects in order to gain a more comprehensive understanding of sustainable practices throughout the lifecycle of clothing products.

There are several limitations to our study. First, considering the limited sample size, the survey cannot represent the perceptions of all Chinese fashion design students, and comparison results may differ depending on students' level of capability. Second, students' perceptions were based on self-evaluation, which could lead to subjectivity and mistakes. Third, the comparison of perceptions of specific sustainable practices at different phases of the clothing lifecycle was not further explored. Further research needs to include a larger sample size with a more diverse range of educational attainment regarding sustainable practices throughout the lifecycle of clothing products. Survey questionnaires that capture more objective information, such as knowledge of sustainable practice in fashion design, will be developed for obtaining more objective results. Furthermore, specific sustainable practices on each phase of clothing lifecycle will be systematically compared among educational institutions to obtain more detailed and specific insights.

Acknowledgements

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