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Research on the Impact of the Combination of Green Design Course in Industrial Design and Nature Experience on Students' Environmental Perception

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While improving people's living standards, the development and progress of science and technology have come with a series of challenges, such as resource depletion, environmental pollution, species extinction, and climate change resulting from global warming. As a demand for sustainable development in society, "Green Design" is expected to continue to be the focus of industrial design education in the 21st century. In this paper, 212 students were selected as objects to carry out relevant research through experimental design. As indicated by the results, 1. Green design course exerts a significantly different influence on environmental perception in the industrial design discipline. 2. Nature experience has a significantly different influence on environmental perception. 3. Industrial design education and nature experience impose a significantly different influence on the improvement of environmental perception. Suggestions were made to provide students with a key made of green design through nature experience activities, with a view to encouraging them to step into the world of nature of truth, goodness and beauty and enhancing their awareness of the environment.

Keywords: industrial design education; green design; nature experience; environmental perception

1 Introduction

As the scientific revolution brought about an increase in human intelligence, traditional social institutions evolved to meet modern functions, along with increasing human control over the environment. With a belief in transcending nature, mankind has achieved unprecedented scientific and technological progress. Despite the enormous benefits, it has led to resource depletion, environmental pollution, species extinction, and climate change as a result of global warming. There is a consensus among experts and scholars that the environmental crisis is an international issue. In spite of different traditions in politics, economics, religion, morality or institutional structures, countries are obliged to contribute to the mitigation of environmental problems by developing appropriate environmental ethics. The unprecedented deterioration of the environment over the years hints at a counterattack from nature, which has left the world suffering major disasters. This not only endangers the existence of present human beings but also poses a threat to the continuation of future generations. According to research on major life experiences, early exposure to nature or the countryside -- that is, spending most of childhood in nature -- greatly influences people's environmental behavior. This indicates that childhood exposure to nature can inspire a love of nature and develop awareness and sensitivity to the environment, which in turn influence the design behavior of students thereafter. Through education, students develop a sensitivity to the environment by being involved in teaching activities. In most cases, however, environmental education offloads the thorny problems caused by human greed onto students, leaving them overwhelmed by immense heaviness and powerlessness before they can experience the beauty of nature. Even if they are offered green design course in the classroom, they are unable to act in the face of real environmental problems. This illustrates one of the important goals of green education: to get students to have a genuine love of the earth and honesty about everything. Before developing respect for life, this is required to first build awareness of it to achieve empathy. Only when students feel connected to their



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environment will they voluntarily make changes to live in harmony with other living things and show concern for life's needs and well-being. This is a prerequisite for industrial design students to graduate with a sense of social responsibility and environmental protection, suggesting the importance of increasing the proportion of green design courses in industrial design. One suggested approach is to cultivate environmental awareness by getting students to approach and interact with nature to develop an emotional connection with the land and the environment. This will plant nature experiences into environmental education to develop seeds of novelty and sensibility in students, and irrigate them through exploration. As for the ultimate solution to environmental problems, consumers should be motivated to care for nature voluntarily through reflection, so that they can take the initiative to understand and practice various environmental protection measures. Due to the current prevalence of commercial practices, material consumption and technological pastimes, the popularity and excitement of an item largely determine whether it is accepted by students, resulting in little nature experience. In view of this, this paper explores the impact of the combination of industrial design education and nature experience on students' environmental perception, so as to provide students with a key made of green design through nature experience activities, with a view to encouraging them to step into the world of nature of truth, goodness and beauty and enhancing their awareness of the environment. Also, this is expected to equip students with a sense of social responsibility and environmental protection after graduation.

2 Literature Review

Hui et al. (2018) hold that art education has the responsibility to provide opportunities for students to explore people, things and sceneries in the living environment, appreciate and talk about artworks, implements and natural landscapes in the environment, and identify the characteristics of art with senses, perceptions and emotions, so as to establish their understanding of the relationship between time, culture, society, life and art. The Ministry of Education (2003) points out that arts and humanities education should be committed to triggering humanistic experiences based on life by means of art. According to Dettmers et al. (2019), art is closely related to the living environment. All arts derive from culture, and the development of culture takes shape from the accumulation of life experience. In this sense, art essentially originates from life. Art education should therefore promote students' self-exploration and awareness of the relationship between the environment and the individual by providing opportunities to explore people, things and places in life. By engaging in artistic expression in a variety of media and forms, their lives and souls will be richer and more diverse. Cheeseman and Wright (2019) suggest that students appreciate and talk about artworks and natural landscapes in the environment through aesthetic and cultural activities, so as to understand the connection between art and life and enhance awareness of the environment. Alonso-Vazquez et al. (2019) believe that art education, which transcends artistry, technicism, formalism and creationism, is the communication between humans and the environment. The behavior of environmental art penetrates into all levels of human life and promotes the dialogue between human and nature, human and human, and human and society. The idea of art education of environmentalism is expected to come from life, be used for life and return to life. Dynia et al. (2018) propose to explore the relationship between humans and the living environment through art behaviors and activities, and to discuss, analyze and synthesize through art practice and thinking to realize the harmonious coexistence of humans and the environment. The following hypothesis is therefore put forward: H1: Green design course in industrial design exerts a significantly different influence on environmental perception.

Through research, Lin and Shih (2018) conclude that industrial design education has paid particular attention to developing students of product design and development's awareness of environmental protection and an intuitive appreciation of the environment, such as touching a stone, listening to the song of a bird or smelling the air in a nearby city. All these contribute to the improvement of students' ability to identify the environment. Campana et al. (2019) argue that, in order to deliberately mobilize students' senses to obtain profound environmental experience, green design courses and activities mostly involve sensory awareness activities to develop students' cognition of the environment and understanding of the importance of environmental protection, so as to enhance their sense of responsibility in design. According to Aregay et al. (2018), nature experience is a key part of flow learning advocated by Joseph Cornell, an American natural educator. By arranging a reasonable situation and a sufficient period of time, the leader leads the learners to engage in experiential activities to learn from the interaction with the environment. Their understanding of nature is enhanced by the game of experience and exploration. In addition to knowledge about nature, Fägerstam and Grothéus (2018) believe that vivid and interesting activities contribute to students' sense, experience and appreciation of nature. Su et al. (2018) appreciate the role of flow learning, as an intellectual

and emotional education method, in guiding people's cognition, feeling, enjoyment and love of nature. Emphasizing that people appreciate nature with their own senses and hearts, Johns and Pontes (2019) hold that only through real interaction with nature can we learn from the wisdom of predecessors to improve ourselves and build the belief of caring for nature. Based on this, the second hypothesis is proposed:

H2: Nature experience has a significantly different influence on environmental perception.

In terms of integrating green design courses in industrial design with nature experience, Jo et al. (2018) advocate introducing spontaneous teaching and intuitive principles to cultivate students' feelings before establishing further knowledge. This is advised to follow the psychology of moving from simple to complex, obeying nature, and ensuring a loving atmosphere during teaching. At the goal level, Zaccone and Petrini (2019) argue that outdoor teaching, like other teachings, involves the three fields of cognition, skills and affection. In terms of learning, Marcinkowski and Reid (2019) suggest that the eyes, ears, nose, tongue, body and other senses should be used for direct understanding and experience through specific operations and experiences. By stimulating learners' interest in carrying out ecological observation of the environment, it gradually develops awareness and builds their understanding of the environment through thinking before it is generalized and applied in life. Appreciation is the main activity in the part of affection, as the development of perception is the precondition for independent thinking and appreciation perspective combined with cognition, followed by objective criticism and value clarification based on experience. Boca and Saraçlı (2019) hold that, by introducing nature experience into green design course of industrial design, it aims to, in term of developing their affection for the environment, stimulate students' interest in nature, build the right attitude towards nature and enhance the connection between participants. In terms of environmental cognition, students are expected to acquire relevant knowledge from nature to expand their scope of knowledge, understand human and design behavior and the dependence between humans and the environment, and thus develop environmentally friendly design concepts. In terms of environmental skills, they will have stronger basic research skills (e.g., observation and measurement) and outdoor skills in working with groups, and initiate green design workshops when necessary. According to Darshana (2018), by providing access to the actual environment, the combination of green design course in industrial design and nature experience encourages learners to realize the importance of environmental protection in design and development, thus establishing a sense of identity for green design courses, triggering concern for the environment, and ultimately achieving the goals of environmental education. To achieve the curriculum objectives of outdoor education, it is suggested to: 1. Extend lessons that take place in the classroom to the outdoors; 2. Design a range of direct outdoor teaching experiences if it is a natural resource or living environment issue to enhance students' awareness of the environment and environmental design; 3. Ensure that outdoor teaching is planned and developed by both teachers and students and outdoor educators. According to Kelly and Reitter (2018), the combination of green design course in industrial design and nature experience is the best way for students to directly contact and feel the changes in the environment. Both human and natural environments can be incorporated to make the most of the available resources, so that students can experience the beauty of their living environment and understand the relationship between environment and art. With a sense of environmental protection and appreciation for the environment, they are expected to contribute to social and environmental protection with an environmental orientation in their design. The following hypothesis is thus raised:

H3: Industrial design education and nature experience impose a significantly different influence on the improvement of environmental perception.

3 Research Methods

3.1 Measurements of Variables

- Green design course in industrial design. By referring to Wu et al. (2019), industrial design education is divided into green design education and general traditional education for experiment.
- Nature experience. By referring to Chiang et al. (2019), nature experience is divided into "with nature experience" and "without nature experience" for experiment.
- Environmental perception. By referring to Huang et al. (2019), according to social ecology, environmental perception is composed of:
 1. Social environmental factors: Including interpersonal, cultural, economic and policy factors.
 2. Physical environmental factors: The axis of ecological sociology theory; physical environment refers to the geographic, architectural, and technological environments that interact with individuals.

3.2 Research Objects and Research Design

Taking 212 students from Zhejiang Gongshang University as subjects, this paper carried out a 2*2 experimental study on green design course and nature experience through experimental design. The experimental grouping is the green design course (green design education; general traditional education) * nature experience (yes; no).

3.3 Experimental Process

- Before experiment: Group the class according to the class size in advance.
- During experiment: Perform group experiments as assigned.
- Questionnaire filling: The objects fill in items related to environmental perception.
- After experiment: The researcher takes back the completed questionnaires for data collection and analysis.

3.4 Analysis Method

According to ANOVA, the influence of green design education on environmental perception and the influence of nature experience on environmental perception are discussed, and the interactive influence of the combination of green design education and nature experience on environmental perception is further identified.

4 Results and Analysis

4.1 Different Influence of Green Design Education on Environmental Perception

Based on ANOVA, this paper explores whether there are differences in the impact of green design education on environmental perception. As shown in Table 1, green design education is significantly different from traditional industrial design education in terms of social environmental factors of environmental perception, and the former is higher than the latter. Similarly, green design education is significantly different from traditional industrial design education in terms of physical environmental factors of environmental perception, and the former is higher than the latter. H1 is therefore validated.

Table 1. Analysis of Differences in Green Design Education

	Variable Name	F Value	P Value	Scheffe Post-verification
Convenient	Social environmental factors	12.751	0.000**	Green design education > General traditional industrial design education
	Physical environmental factors	26.833	0.000**	Green design education > General traditional industrial design education

* means $p < 0.05$, and ** means $p < 0.01$

4.2 Different Influence of Nature Experience on Environmental Perception

Based on ANOVA, this paper discusses the differences in the effects of nature experience on environmental perception. As can be seen from Table 2, with nature experience is significantly different from without nature experience in the aspect of social environmental factors of environmental perception, and the former is higher than the latter. Similarly, with nature experience is significantly different from without nature experience in the aspect of physical environmental factors, and the former is higher than the latter. H2 therefore holds.

Table 2. Analysis of Differences in Nature Experience

	Variable Name	F Value	P Value	Scheffe Post-verification
Nature experience	Social environmental factors	18.675	0.000**	With > Without
	Physical environmental factors	33.196	0.000**	With > Without

* means $p < 0.05$, and ** means $p < 0.01$

4.3 Different Influence of Green Design Education and Nature Experience

Based on ANOVA, this paper identifies the difference between the influence of green design education and nature experience on environmental perception, and explores the interaction between green design education and nature experience to verify the effect of nature experience through two-way ANOVA. According to the interaction in Table 3, green design education and nature experience have the best effect on social

environmental factors of environmental perception, the same is true for physical environmental factors of environmental perception, thus verifying H3.

Table 3. Analysis of Different Influence of Green Design Education and Nature Experience on Environmental Perception

Variable Name	Social Environmental Factors			Physical Environmental Factors		
	F Value	P Value	Scheffe Post-verification	F Value	P Value	Scheffe Post-verification
Green design education	12.751	0.000**	Green design education > General traditional industrial design education	26.833	0.000**	Green design education > General traditional industrial design education
Nature experience	18.675	0.000**	With > Without	33.196	0.000**	With > Without
Green design education * Nature experience	41.694	0.000**	11>21>22>12	45.267	0.000**	11>21>22>12

* means $p < 0.05$, and ** means $p < 0.01$

5 Conclusion

As the experimental results suggest, the introduction of nature experience to green design course in industrial design not only stimulates students' enthusiasm and attention, but also brings direct experience and inspiration. Experiential courses are designed to demonstrate a layered and enriched teaching arrangement for the benefit of both students and teachers. Based on the mindset of students, the combination of green design course and nature experience sparks student interest before encouraging them to deepen their awareness and experience of the environment through personal observation and experience in a variety of novel and interesting activities. This complies with their energetic and active nature, and stimulates their curiosity for outdoor exploration, practical observation and creation, thereby enhancing their knowledge of the ecological environment while experiencing the joy of learning. Still, the development of a sound curriculum plan requires a process of theoretical discussion, conceptual design, practical implementation, and multiple feedbacks. Hence, teaching and curricula are expected to be responsive to students' needs, teachers' abilities and objective conditions, rather than be idealized blindly. In the organization of nature experience-related teaching activities, the choice of location, allocation of time, introduction of study sheets and random instructional design should all be taken into account. This is expected to improve the deficiencies in teaching practice for the benefit of students by designing courses that are truly suitable for students, introducing incentives to encourage their creation and expression at the right time, launching appropriate group activities to avoid being out of order, and integrating teachers, teaching and field resources to meet students' learning needs. More importantly, efforts should be made to raise the environmental awareness of industrial design students through green design courses to ensure that they adhere to environmental concepts and humanistic concerns in future product design and development.

References

- Alonso-Vazquez, M., Packer, J., Fairley, S., & Hughes, K. (2019). The role of place attachment and festival attachment in influencing attendees' environmentally responsible behaviours at music festivals. *Tourism Recreation Research*, 44(1), 91-102.
- Aregay, F. A., Minjuan, Z., & Tao, X. (2018). Knowledge, attitude and behavior of farmers in farmland conservation in China: an application of the structural equation model. *Journal of environmental planning and management*, 61(2), 249-271.
- Boca, G. D., & Saraçlı, S. (2019). Environmental Education and Student's Perception, for Sustainability. *Sustainability*, 11(6), 1553.
- Campana, K., Kociubuk, J., & Mills, J. E. (2019). Making Space for Storytime: The Role of the Environment in the Production of Storytime. *Public Library Quarterly*, 1-17.
- Cheeseman, A., & Wright, T. (2019). Examining environmental learning experiences at an earth education summer camp. *Environmental Education Research*, 1-13.
- Chiang, F. K., Chang, C. H., Hu, D., Zhang, G. & Liu, Y. (2019). Design and Development of a Safety Educational Adventure Game. *International Journal of Emerging Technologies in Learning*, 14(3), p201-219.
- Darshana (2018). Pro-Environmental Behavior: The Role of Public Perception in Infrastructure and the Social Factors for Sustainable Development, *Sustainability* 10(4).
- Dettmers, S., Yotyodying, S., & Jonkmann, K. (2019). Antecedents and outcomes of parental homework

- involvement: How do family-school partnerships affect parental homework involvement and student outcomes. *Frontiers in psychology*, 10.
- Dynia, J. M., Schachter, R. E., Piasta, S. B., Justice, L. M., O'Connell, A. A., & Yeager Pelatti, C. (2018). An empirical investigation of the dimensionality of the physical literacy environment in early childhood classrooms. *Journal of Early Childhood Literacy*, 18(2), 239-263.
- Fägerstam, E., & Grothéus, A. (2018). Secondary School Students' experience of outdoor learning: a Swedish case Study. *Education*, 138(4), 378-392.
- Huang, S. H., Yin, H. B. & Lijie L. V. (2019). Job characteristics and teacher well-being: the mediation of teacher self-monitoring and teacher self-efficacy. *Educational Psychology*, 39(3), 313-331.
- Hui, N., Saxe, S., Roorda, M., Hess, P., & Miller, E. J. (2018). Measuring the completeness of complete streets. *Transport reviews*, 38(1), 73-95.
- Johns, R. A., & Pontes, R. (2019). Parks, rhetoric and environmental education: challenges and opportunities for enhancing ecoliteracy. *Journal of Outdoor and Environmental Education*, 22(1), 1-19.
- Jo, Y.-I., Lee, J.-L., & Koo, J.-H. (2018). Effect of Physical Environment and Programs on the Social Interaction of Youth Space Users in Seoul in the Case of Pilot Projects. *Sustainability*, 10(12), 4515.
- Kelly, M. & Reitter, D. (2018). How Language Processing can Shape a Common Model of Cognition. *Procedia Computer Science*, 145, 724–729.
- Lin, C. H. & Shih, J. L. (2018). Analysing group dynamics of a digital game-based adventure education course. *Educational Technology & Society*, 21(4), 51-63.
- Marcinkowski & Reid (2019). Reviews of research on the attitude–behavior relationship and their implications for future environmental education research. *Environmental Education Research*, 25:4, 459-471.
- Su, L. J., Huang, S. S., & Pearce, J. (2018). How does destination social responsibility contribute to environmentally responsible behaviour? A destination resident perspective. *Journal of Business Research*, 86, 179-189.
- Wu, H.-C., Ai, C.-H., & Cheng, C.-C. (2019). Experiential quality, experiential psychological states and experiential outcomes in an unmanned convenience store. *Journal of Retailing and Consumer Services*, 51, 409-420.
- Zaccone, M., & Petrini, M. (2019). The effects of intrinsic motivation and extrinsic motivation on students' learning effectiveness. Exploring the Moderating Role of Gender, *International Journal of Educational Management*, 33 (6) 1381-1394.

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