Analysis of the Basic Teaching of Industrial Design in the Digital Intelligence Era

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Abstract. With the rapid development of new technologies such as artificial intelligence and virtual reality, the field of Industrial Design is undergoing unprecedented changes. The purpose of this paper is to discuss the reform and innovation of basic teaching of industrial design in the Digital Intelligence era. Firstly, the impact of the digital intelligence era on industrial design is analyzed, and the need for industrial design education to keep pace with the times is emphasized. Then, the basic goals and strategies of industrial design education in the new era are proposed, and an education model with humanistic education as the basic orientation, new technologies integrated into teaching, and project-driven practical learning is proposed. Practical examples demonstrate the application effect and potential of these methods. This paper provides new ideas and methods for the basic teaching of industrial design in the Digital Intelligence era, aiming to cultivate design talents with innovative ability and practical skills.

Keywords: the Digital Intelligence Era. Industrial Design Education. Humanistic education. New Technologies. Project-driven practical learning.

1. Introduction

1.1. The impact of the Digital Intelligence era on Industrial Design

With the advent of the digital intelligence era, new technologies marked by big data, artificial intelligence, and the Internet of Things are developing rapidly, and are widely used in all aspects of society, changing the way people live their daily lives. Industrial design, which is committed to "innovation changes life", is deeply influenced by the digital intelligence era, which not only reshapes the way design works, but also changes the design process and the interactive relationship with users. Most importantly, it redefines the concept of industrial design[1], including interdisciplinary integration, technological application innovation, user experience innovation, digital and physical world integration, environmental, economic, and social sustainability.

1.2. The importance and necessity of the research

With the rapid development of intelligent technology, the traditional industrial design basic teaching design basic education needs to adapt to the trend of intelligence and study how to integrate new ideas and technologies into teaching.

The core purpose of industrial design education[2] is to develop designers who can adapt to the needs of the future market. In the Digital Intelligence era, designers not only need to have traditional aesthetic literacy and manual skills, but also need to master the knowledge of emerging technologies such as data analysis and artificial intelligence. Therefore, it is very important to study how to build an education model that meets the requirements of the times to deliver qualified talents.

At the same time, the teaching of basic design is an important part of stimulating students' creativity and imagination. By studying the basic education of design in the Digital Intelligence era, we can explore how to better cultivate students' innovative thinking[3] and experimental spirit, and then promote the innovation and development of the entire industry. In addition, the research in this direction will help educators understand the gap between the current design of basic education and the needs of the industry, optimize the teaching model and strategy, and better help the cultivation of innovative talents in the industry.

2. Background analysis in the Digital Intelligence era

2.1. The development of intelligent technologies and their impact on industrial design

The core purpose of industrial design education is to develop designers who can adapt to the needs of the future market. In the Digital Intelligence era, designers not only need to have traditional aesthetic literacy and manual skills, but also need to master the knowledge of emerging technologies such as data analysis and artificial intelligence. Therefore, it is very important to study how to build an education model that meets the requirements of the times to deliver qualified talents.

The development of intelligent technology is rapidly changing the face of industrial design. With the continuous advancement of technologies such as artificial intelligence, Internet of Things, big data analysis, and machine learning, designers have gained new design tools and methods, and are able to better understand user needs, predict market trends, and optimize product performance.

By analyzing user behavior data, designers can more accurately grasp user needs and design products that better meet user expectations. In addition, smart technology enables products to interact with users on a deeper level and provide a personalized experience.Smart technology is also driving innovation in design approaches. For example, through virtual reality and augmented reality technology, designers can more intuitively display and test design solutions, improving the efficiency and accuracy of design decisions. In addition, the application of advanced manufacturing technologies such as 3D printing also provides designers with greater design freedom and faster prototyping capabilities.

2.2. Challenges and opportunities for industrial design in the Digital Intelligence era

The Digital Intelligence era has brought unprecedented challenges and opportunities to industrial design. In terms of challenges, first of all, designers need to continuously learn and master emerging intelligent technologies, such as artificial intelligence, Internet of Things, big data analysis, etc., to keep their designs forward-looking and competitive. Second, the

complexity of the design has increased significantly, as smart products often involve multiple layers such as software, hardware, user interface, and data interaction. In addition, privacy and security concerns are becoming increasingly prominent, and designers must ensure that products are secure and compliant when collecting and using data. Finally, designers need to give more thought to the sustainability and ethical implications of their products in order to address environmental concerns and the requirements of social responsibility.

In terms of opportunities, the application of smart technologies has greatly expanded the possibilities of industrial design. Designers can use smart technology to develop personalized products that can adapt to the needs of different users. At the same time, through data analysis, designers can more accurately predict market trends and user preferences, thus creating designs that are more in line with market and user needs. In addition, smart technology fosters interdisciplinary collaboration, providing a platform and opportunity for designers to collaborate with experts in other fields.

In short, the Digital Intelligence era has brought new challenges to industrial design, and at the same time, it has also provided designers with a broad space for development and innovation opportunities.

2.3. Challenges to industrial design education in the Digital Intelligence era

In the context of the Digital Intelligence era, the teaching needs of industrial design have changed significantly. [4]First of all, due to the acceleration of technological upgrading, industrial designers need to have a more comprehensive knowledge system, including knowledge in computer science, engineering, human-computer interaction and other fields. Secondly, the demand for designers in the market has also changed, no longer only focusing on the skills and aesthetics of design, but more on the practicality, innovation and user experience of design. This requires designers to not only master traditional design skills, but also have interdisciplinary knowledge and innovative thinking skills. Therefore, the changes in teaching needs have put forward higher requirements for teachers, who need to have more knowledge and practical experience to meet the needs of students.

The educational philosophy of the Digital Intelligence era emphasizes the cultivation of students' innovation ability and practical ability. In the field of industrial design, this means focusing on cultivating students' innovative thinking, practical skills and teamwork spirit. At the same time, the educational philosophy also needs to focus on cultivating students' lifelong learning ability and self-directed learning ability, so that they can adapt to the rapidly changing social and technological environment. In addition, the educational philosophy also needs to focus on the individualized development of students, encourage them to develop their own strengths and interests, and tap their potential and creativity.

Teaching methods in the age of Digital Intelligence emphasize diversity and flexibility. No single definition of design, or branches of professionalized practice such as industrial or graphic design, adequately covers the diversity of ideas and methods gathered together under the label.[5] In the field of industrial design, traditional teaching methods can no longer meet the needs of students, and more innovative and practical teaching methods are needed. For example, project-based learning, cooperative learning, and online learning can be used to allow students to learn and grow by doing. At the same time, the teaching focuses on students' participation and interaction, and encourages them to actively explore and discover new

knowledge and skills. In addition, teaching also needs to pay attention to students' feedback and evaluation, so as to adjust the teaching content and methods in a timely manner to improve the quality and effectiveness of teaching.

In short, the Digital Intelligence era has brought great influence and challenges to industrial design education. The changing needs of teaching require teachers to have more knowledge and practical experience; The change of educational philosophy requires that attention be paid to cultivating students' innovative spirit and practical habits in the basic learning stage. Innovation in teaching methods requires a greater focus on student participation and interaction. These challenges are also opportunities, which provide a new direction and impetus for the development of industrial design education.

3. Design basic teaching objectives and strategies in the Digital Intelligence era

3.1. Cultivate professional interests

In the Digital Intelligence era, the key to improving students' professional interest in the basic teaching of industrial design lies in combining traditional teaching content with modern intelligent technology to stimulate students' creativity and practical ability. For example, in the basic teaching of design sketching (as shown in Figure 1), "maze design" is introduced. Through the project, students were asked to design a fun maze and apply design sketches to present the design concept. In addition to hand-drawing, students are encouraged to teach themselves 3D modeling software or handmade prototyping to complete their designs. Finally, at the end of the class, students will explain their design ideas in detail through on-site explanations and work displays, and accept the evaluation of classmates and teachers. Through such project-based learning, students can not only experience the design process and graphic expression application methods for the first time, but also experience the design report and design display, and gain a sense of accomplishment and honor. In addition to enhancing the enthusiasm for professional learning, it is also necessary to improve the communication and presentation skills of freshers.
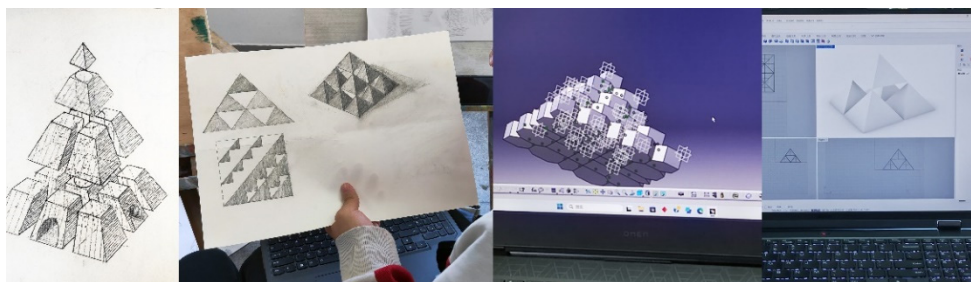

Fig. 1. Labyrinth design

3.2. Improve professional awareness

Through such project-based learning, students can not only experience the design process and graphic expression application methods for the first time, but also experience the design report

and design display, and gain a sense of accomplishment and honor. In addition to enhancing the enthusiasm for professional learning, it is also necessary to improve the communication and presentation skills of this year.

In the Digital Intelligence era, the basic teaching of industrial design should focus on the introduction of new technologies and the application of practical cases, so that students can intuitively understand the cutting-edge dynamics and practical significance of industrial design.

For example, as shown in Figure 2, the "Stitching Toy Design" project is introduced in the model technology course. In the project, through the introduction of splicing toy products and markets, students are guided to analyze the characteristics of target users, formulate design goals, and develop creative ideas on the basis of considering aesthetics, functionality and user experience. After that, students use sketches, 3D modeling, and handmade models to concretize their ideas, and use aurora cutting and 3D printing to achieve prototype design. Finally, the scheme is optimized through test feedback and iterative design.

This case not only allows students to master the basic design skills in practice, but also makes them aware of the close integration of intelligent technology and industrial design, so as to improve their professional awareness and future employment direction.

To sum up, the teaching goal of Design Fundamentals is to help students experience and realize design through various practical means, cultivate their enthusiasm for design, and improve their comprehensive understanding of the design profession, so as to lay a solid foundation for becoming qualified designers in the future.

Fig. 2. Rose patchwork toy design

3.3. Cultivate creative thinking and expression habits

In the Digital Intelligence era, improving students' creative thinking[6] and expression habits in the basic teaching of industrial design can stimulate students' creative thinking and effectively express their design ideas through the integration of new technologies, new tools and new methods.
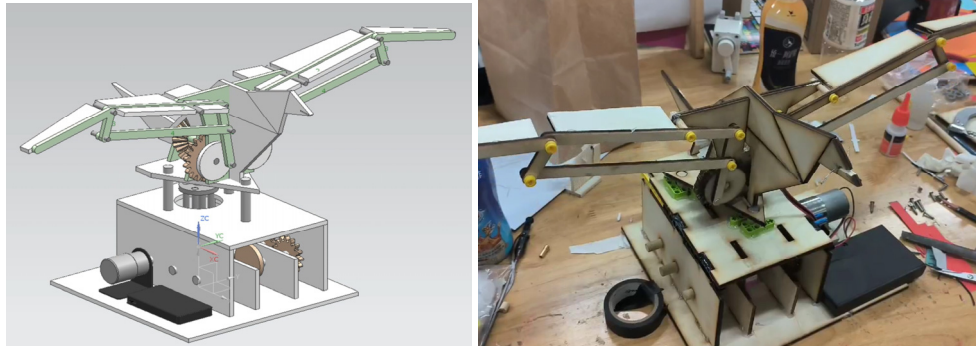
Figure. 3. EAGLE Wings structure design

For example, as shown in Figure 3, the practical topic of "EAGLE Wings" is set up in the Mechanical Design Fundamentals course. In this project, the teacher first introduces the basic principles and real-life application scenarios of the virtual mechanical interactive device to the students. The students were then asked to design an interactive installation that met real-world needs and that enhanced the user's sense of immersion and engagement.

Through brainstorming and user research, students identify the target users and design goals for the interactive installation. Sketches, BLender 3D modeling software, and animation were then used to create a prototype of the design. In doing so, teachers encourage students to experiment and explore, exploring new ways of interacting and designing concepts.

Finally, students demonstrate their designs through mock-up samples, and evaluate and discuss the user experience and design effects. This case not only exercised the students' creative thinking ability, but also cultivated their habit of using modern technological tools for design expression.

3.4. Cultivate a spirit of exploration and a habit of trial and error

In the Digital Intelligence era, it is crucial to cultivate students' spirit of exploration and trial and error habits. This requires teaching not only to impart knowledge, but also to encourage practical and innovative thinking. Taking Figure 4 as an example, the "Device Structural Design" item is introduced into the structural design.
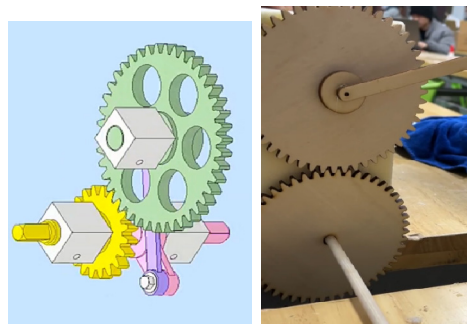

Figure. 4. Gear transmission structure

First, the teacher introduces the modular design concept and its application, emphasizing that it is a process that allows for errors and rapid iteration. The students were then divided into teams, and each team was tasked with designing the module for a specific function. In the teaching process, students are required to research relevant technologies such as transmission, control and connection on their own, and develop creative ideas. They are encouraged to prototype and test quickly, where they identify problems and deficiencies in the design. Refine the design through trial and error. Eventually, all teams presented their work. In the process, students experience the value of trial and error, learn how to accept failure and learn from it, and develop the spirit of exploration and complex problem-solving skills[7].

4. The application of the concept of humanistic education in the design of basic teaching

4.1. Cultivate professional interests

The concept of humanistic education emphasizes individualized development, life practice and social participation in the design of basic teaching. It is embodied in the following three aspects.

First, the student-centered teaching strategy emphasizes the needs and interests of students, and focuses on cultivating students' initiative and innovation. In design teaching, teachers can guide students to choose design topics according to their own interests and needs, and encourage students to explore and practice independently, so as to improve students' learning enthusiasm and innovation ability.

Secondly, empirical learning in connection with life emphasizes the combination of learning content and real life, so that students can learn and understand knowledge in practice. In design teaching, teachers can guide students to observe and analyze design phenomena in life, and understand and master design principles and methods through practical operation and practice.

Finally, the practical topics that focus on society can combine the teaching content with social hot issues, so that students can pay attention to the society and improve their sense of social responsibility in learning. In design teaching, teachers can choose some social hot issues as design topics to guide students to think and solve problems from the perspective of design, so as to improve students' sense of social responsibility and problem-solving ability.

In the practical project of "Nanjing City Tourism", the teacher first organized students to learn about the history and culture of Nanjing, and then asked students to design a special tourism route from different perspectives (such as history, art, and ecology). Students were required to research the needs of tourists, consider the traffic conditions of the city, and creatively plan their travel plans based on the actual geographical environment. Eventually, each team produced a detailed travel guide, including a map, schedule, recommended attractions, etc., and presented their design ideas and results to the class. Through project practice, students not only learned how to apply design principles to practical problems, but also improved their awareness and communication skills of local culture, while exercising teamwork and project management skills.

5. New content, new tools

In the Digital Intelligence era, it is extremely important for students to grasp the latest design concepts and technical trends by integrating the cutting-edge knowledge and trends of the industry into the basic teaching of industrial design. This integration helps to improve students' market competitiveness and adaptability for future employment.

At the same time, the introduction of new technologies and new tools is essential for the basic teaching of industrial design, such as virtual reality (VR) (as shown in Fig 5), augmented reality (AR) technology, 3D printing, AI, etc., which can provide an intuitive design experience, promote students' spatial imagination and innovative thinking, and improve the accuracy and efficiency of design. It provides valuable experience and skills for their future careers in the field of industrial design. Through the application of these new technologies and tools, industrial designers can create with unprecedented speed and precision, while improving the innovation and functionality of their designs.

Fig. 5. VR teaching

In the Digital Intelligence era, new design methods in the basic teaching of industrial design emphasize the concepts of interdisciplinary integration, user experience design (UX), and iterative and participatory design. The importance of these new design approaches lies in their ability to help students better understand and respond to rapidly changing market needs and technological developments, while developing innovative thinking and problem-solving skills. Through this new approach to design, students not only learn how to use smart technology for innovative design, but also master skills on how to optimize products through UX design and participatory design. This provides them valuable experience and skills for their future careers in the field of industrial design.

6. Conclusions

The development of intelligent technology is profoundly influencing the concept and method of industrial design education. The results show that the application of new technologies and tools can improve teaching efficiency, stimulate students' creativity, and improve their practical skills. At the same time, the introduction of new design methods such as

interdisciplinary integration, user experience, and participatory design will help students better adapt to the challenges of future design.

In terms of future trends, it is expected that intelligent technology will continue to penetrate into all fields of design, and industrial design education will pay more attention to data-driven design methods and intelligent product innovation. In addition, as technology advances, there is likely to be a further shift in education models towards online and blended learning, providing a more flexible and personalized learning experience. In order to construct a new mode we need a method, that is to say, an objective system[8].

Follow-up research suggests to focus on the continuous integration process of intelligent technology in industrial design education, and how to more effectively cultivate students' innovative thinking and interdisciplinary collaboration ability. At the same time, the research should explore how to balance technology and humanistic care in the teaching process, so as to ensure that the future direction of design education is in line with the trend of technological progress without losing the principles of anthropocentric design.

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