Paradigm Academic Press
Research and Advances in Education
ISSN 2788-7057
OCT. 2025 VOL.4, NO.8

A Study on Design Aesthetic Education and Innovation-Driven Teaching from the Perspective of Kansei Engineering — Taking the Course "Intelligent Agricultural Equipment System Design" at Jiangsu University as an Example

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doi:10.63593/RAE.2788-7057.2025.10.004

Abstract

Against the strategic backdrop of rural revitalization and building a strong agricultural nation in China, design education urgently needs to respond to the demands of the times by cultivating innovative talents capable of deeply integrating technology, culture, and aesthetics. This paper takes the course "Intelligent Agricultural Equipment System Design" as a practical vehicle, integrating the ternary theories of Kansei Engineering, a new-era "farming-reading" culture, and agricultural intelligent-manufacturing aesthetics to construct a teaching framework connecting user emotions, cultural roots, and technological aesthetics. The core of the course systematically translates the four aesthetic dimensions of "Form, Meaning, Intelligence, and Reflection" into four core competencies that design students should possess: Innovation in Form and CMF, Scene and Narrative Construction, Interaction and System Integration, and Sustainability and Social Responsibility. Through a meticulously designed "Five Questions, Five Answers, One Extension" teaching path, along with diversified methods such as project-based learning, interdisciplinary workshops, and virtual-physical combined field studies, the course achieves an integrated cultivation of aesthetic perception, cultural understanding, value shaping, and innovative ability. This paper elaborates on the course's theoretical model, instructional design, implementation process, and innovative features, providing a referential paradigm for teaching reform practices that deeply integrate professional education, aesthetic education, and quality education within design-related disciplines.

Keywords: design education, aesthetic education, Kansei engineering, intelligent agricultural equipment system design, farming-reading culture

1. Introduction

The modernization of agricultural equipment is the material foundation and a distinct hallmark of building a strong agricultural nation. From the traditional labor of "facing the loess with backs to the sky" to the modern vision of "unmanned farms" and "smart fields," agricultural equipment has undergone a profound transformation from manual and mechanized to digitalized and intelligent. This transformation is not merely technological evolution but also a reshaping of production models, industrial forms, and even the relationship between humans and the land. In this process, design, especially industrial and product design, plays a crucial role in translating cutting-edge technologies into innovative products that are perceptible, operable, and resonant for users. Excellent intelligent agricultural equipment should not only be efficient production tools but also become "new artifacts" that integrate functional rationality, technological beauty, and cultural connotations, carrying the agricultural ideals of the new era.

However, current design education often faces a dual disconnection when addressing this field: first, a disconnection between technology and the humanities, where teaching tends to focus narrowly on hardware styling or interface interaction, lacking a deep understanding of the entire agricultural production chain and its underlying culture; second, a disconnection between aesthetics and innovation, where aesthetic education is often confined to teaching formal principles or appreciating artistic styles, failing to effectively transform into an endogenous driver for innovative design. This results in design outputs that can easily become superficial, struggling to address the core pain points and spiritual essence of smart agriculture.

Therefore, the teaching reform of the "Intelligent Agricultural Equipment System Design" course represents a deep practice of "educating through aesthetics," aiming to respond to both the era's demands and educational realities. By constructing an innovative aesthetic education curriculum system, it seeks to cultivate interdisciplinary design talents who master modern design methods, understand the essence of agricultural civilization, and can serve national strategies with aesthetic awareness and innovative thinking.

2. Constructing the Theoretical Framework: The Ternary Fusion of Kansei Engineering, Farming-Reading Culture, and Intelligent-Manufacturing Aesthetics

To support the goal of aesthetic education for design majors, it is necessary to construct a theoretical framework that integrates rational design tools, profound cultural resources, and forward-looking aesthetic paradigms.

2.1 Core Methodology: Kansei Engineering

Kansei Engineering is a key theory and method connecting users' subjective emotions with products' objective design parameters (Ding Qingzhen & Tang Changqiao, 2024). Introducing Kansei Engineering is particularly important for agricultural equipment, an object often perceived as "cold machinery." The course guides students to systematically collect and analyze the kansei (affective) needs of target users (e.g., new professional farmers, farm managers, agricultural tech companies) for intelligent equipment (Jia Danping, Jin Jian, Geng Qian & Deng Siyu, 2020) — such as "reliable," "efficient," "friendly," "technological," "harmonious with the environment" — using tools like semantic differential scales and mood boards. Students are then guided to use multivariate statistical analysis to deconstruct these abstract impressions and translate them into specific design elements, including the curvature and tension of form, the semantics and combinations of color, the texture and temperature of materials, and the logic and rhythm of human-machine interaction. For instance, a sense of "reliability" might be associated with a stable base form, low-brightness colors, and surface materials with tactile friction; "technological sense" could be conveyed through clean linear light guides, semi-transparent material treatments, and integrated styling. This process shifts the perception of "beauty" from subjective judgment to a scientific, reproducible, and optimizable design workflow based on user research and data, rooting aesthetic education in the soil of real user experience.

2.2 Cultural Foundation: The Design Transcreation of a New-Era Farming-Reading Culture

"Farming and reading perpetuating the family" is an ideal spiritual vision in traditional Chinese agrarian society. In this course, we propose a "new-era farming-reading culture," imbuing it with new connotations for design education (Zhang Lingling, 2025; Huang Zhengjun, Li Qian, Zhu Xinghui & Shao Hua, 2025): "Farming" refers to hands-on practice, deeply understanding the "affairs" and "context" of smart agriculture. This requires students to understand practical issues like crop growth cycles, field operation constraints, and farmers' actual pain points through research, field studies, and internships. "Reading" refers to studying classics, drawing wisdom from the "artifacts" and "philosophy" of traditional farming culture. This involves not only learning the design philosophies from classics like Tiangong Kaiwu and Nong Zheng Quan Shu but, more importantly, comprehending the ecological philosophies and ethical concepts within, such as "conforming to the seasons," "taking from nature with restraint," and "artifacts conveying principles."

The course focuses on achieving the creative transcreation of this culture (Zhao Weidong, Hu Weizhuan, Zhang Yudian & Chen Beibei, 2024). For example, the intensive wisdom of traditional "intensive and meticulous farming" can be transcreated into the relentless pursuit of equipment operation precision and resource utilization efficiency. The principles of "excellent materials and fine craftsmanship" and "making the best use of everything" in traditional farm tools can be reflected in sustainable design practices such as material selection, structural design, and repairability. By transforming "farming-reading" from a cultural sentiment into an attitude and method for design research, students can establish a spiritual connection with Chinese agricultural civilization, making their design innovations well-founded and deeply rooted.

2.3 A New Aesthetic Paradigm: A Multidimensional Analysis of Agricultural Intelligent-Manufacturing Aesthetics

China has been a major agricultural country since ancient times. Its long-standing farming civilization, the cradle and foundation of Chinese civilization, has profoundly shaped the aesthetic psychology and artifact-creation concepts of the Chinese nation through philosophies such as "harmony between man and nature," "conforming

to nature," and "intensive and meticulous farming." (Zou Qichang, 2017) Traditional farm tools like the leisi (Chinese ancient plough), curved-shaft plow, and waterwheels are not only production tools but also exemplars combining utility and aesthetics, embodying the four aesthetic dimensions of design: "Form, Meaning, Intelligence, and Reflection" (Figure 1) (Li Yanzu, 2007; Zhao Jianghong, 2010). Their forms (Form) directly serve function, being simple yet forceful; their naming and decoration (Meaning) often embody wishes for favorable weather and bountiful harvests; their structures (Intelligence) reflect a profound understanding and ingenious application of material properties and mechanical principles; their holistic conception (Reflection) is permeated with the artifact-creation philosophy of "creating artifacts based on images" and "excellent materials and fine craftsmanship." (Liu Guanzhong, 2019) This provides a profound local cultural context for understanding "the beauty of design."

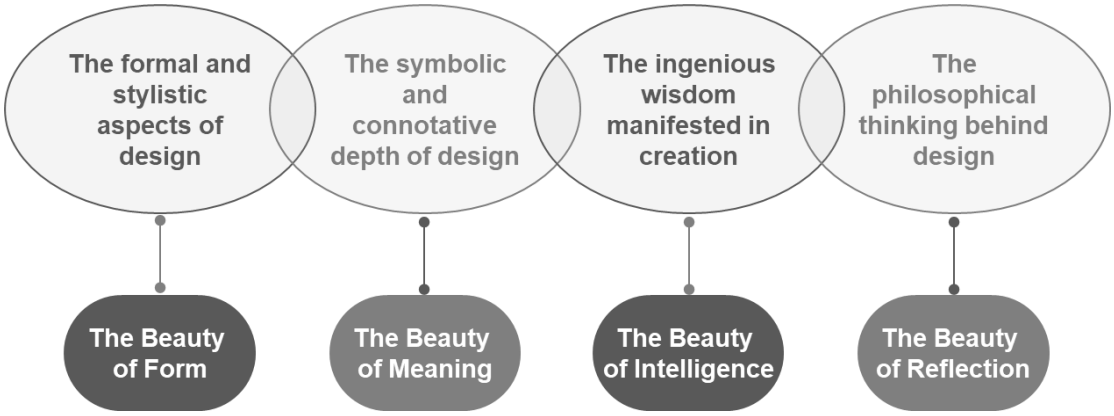

Figure 1. "Four Beauties" Perspective

Building upon the inheritance of traditional Chinese artifact aesthetics, the aesthetics of agricultural equipment in the intelligent era have further evolved into a new paradigm of "Agricultural Intelligent-Manufacturing Aesthetics," characterized by multi-layered and systematic features (Cui Kai & Feng Xian, 2022):

The Beauty of Structural Function: Manifested in the ordered motion of precision mechanisms and the collaborative operation directed by intelligent algorithms, presenting a rational beauty of precision and efficiency akin to mechanical timepieces.

The Beauty of Human-Machine Interaction: Manifested in the smooth and friendly interactive experience co-created by a clean and intuitive graphical interface, an information architecture that aligns with cognitive logic, and clear feedback (Ma Chaomin, Zhao Danhua & Xin Hao, 2020; Xin Xiangyang, 2015).

The Beauty of System Service: Manifested in the seamless connection and collaboration between individual equipment and cloud data platforms, remote management systems, and other intelligent devices, showcasing the systemic and holistic intelligence of the Internet of Everything.

The Beauty of Sustainable Ecology: Manifested in the fusion of instrumental rationality and ecological ethics (Yao Jun, 2020). For example, the design of a "Tree-shaped Intelligent Vertical Farming System," (School of Photoelectric Engineering, Changzhou Institute of Technology, 2023) through the efficient recycling of light, water, and fertilizer resources to increase output in three-dimensional space, vividly illustrates the technological poetry under the vision of "carbon neutrality."

3. Course Instructional Design: From Appreciating the "Four Beauties" to Cultivating the "Four-Dimensional" Innovative Capabilities

The core instructional design of this course is to translate the aforementioned theoretical framework into an executable and assessable teaching system, achieving a leap from static aesthetic "appreciation" to dynamic design "innovation."

3.1 Restructuring the Teaching Objective System

3.1.1 Knowledge Level

Master the basic methods of Kansei Engineering; understand the intrinsic connection between traditional Chinese design thought (e.g., "The heavens have their seasons, the earth its energy, materials have their beauty, and craftsmanship its skill" from The Artificers' Record) and agricultural intelligent-manufacturing aesthetics; become familiar with the mainstream technological architecture and design trends of intelligent agricultural

equipment.

3.1.2 Capability Level

Be able to use the "Four-Dimensional" capability model to complete the full-process design from user research to conceptual proposals; integrate aesthetic considerations into innovative design ideation; possess the integrative ability to communicate and collaborate within interdisciplinary teams.

3.1.3 Quality and Value Level

Establish a professional sense of mission for "design for the people" and "design to revitalize agriculture"; develop the thinking habit of examining design decisions from the perspectives of cultural heritage and sustainable development; strengthen the sentiment of serving the country through science and technology and cultural confidence while appreciating the beauty of "intelligent manufacturing in a major nation."

3.2 Teaching Priorities and Difficulties

3.2.1 Priorities

Guide students to proficiently master the transformation method from "kansei impressions to design elements" and to organically integrate the philosophical concepts of "farming-reading culture" with the technical features of "intelligent-manufacturing aesthetics" in specific design projects for innovative expression.

3.2.2 Difficulties

First, overcoming students' sense of unfamiliarity and distance from the agricultural field to stimulate their design interest and empathy; second, helping students establish a holistic understanding of the complex system of smart agriculture within limited class hours to avoid fragmented design.

3.3 Deep Implementation of the "Five Questions, Five Answers, One Extension" Teaching Path

To address the priorities and difficulties, the course employs a problem-chain-driven model of "Five Questions, Five Answers, One Extension," closely aligned with teaching objectives (Figure 2).

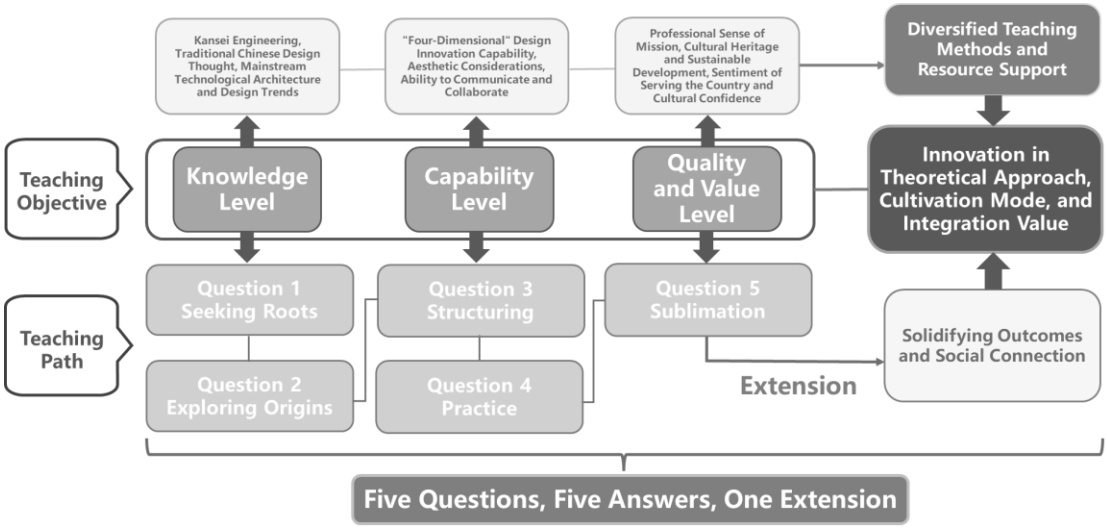

Figure 2. "The Five Questions, Five Answers, One Extension" Teaching Path

3.3.1 Question 1: Seeking Roots — From the "Leisi" to "Intelligence," Where Do Our Design Origins Lie?

Intent: Break the barrier digital natives have towards agriculture and establish a grand narrative of civilizational continuity.

Development: By comparing a Neolithic wooden lei with the control interface of a modern unmanned tractor, guide students to contemplate the evolution of human-land interaction — from "hand-gripping" to "finger-touching" — and the consistent core needs behind it: labor-saving, efficiency-enhancing, and precision. Systematically trace the lineage of farm tool development from "leisi – plow and hoe – agricultural machinery – intelligent equipment," allowing students to viscerally feel how the thread of design history is deeply rooted in agriculture, humanity's most fundamental practice for survival and development.

3.3.2 Question 2: Exploring Origins — Why Must Design Majors Focus on Agricultural Equipment?

Intent: Clarify professional responsibility and era opportunities, facilitating a shift in identity from "observer" to "participant."

Development: Explain that the agricultural field is the "ultimate testing ground" for complex design: it involves multiple challenges such as environmental adaptation, human-machine collaboration, system integration, and social responsibility. This constitutes precisely the comprehensive training needed to cultivate a mature designer. Simultaneously, by interpreting national policies and analyzing market data, illustrate that smart agriculture is a design frontier brimming with both opportunities and responsibilities.

3.3.3 Question 3: Structuring — How to Decode and Encode "Agricultural Beauty" Using the Language of Design?

Intent: Analyze the four aesthetic dimensions of "Form, Meaning, Intelligence, and Reflection" and translate them into a "Four-Dimensional" design innovation capability framework (Table 1).

Development: Deliver detailed lectures combining classic cases. For example, analyze a specific brand's intelligent seeder: its sleek, flowing form reflects the pursuit of Innovation in Form and CMF; its promotional narrative of "growing with farmers" embodies Scene and Narrative Construction; its data synchronization with farm management software demonstrates strong Interaction and System Integration; its material recyclability rate exceeding 90% practices Sustainability and Social Responsibility.

Table 1. The Transformation Framework: Translating Aesthetic Dimensions into Design Innovation Capabilities

"Four Beauties" Perspective	***"Four-Dimensional" Design Innovation Capability***	***Corresponding Design Methods and Outputs***
The Beauty of Form	Innovation in Form and CMF	Kansei mood boards, form exploration sketches, CMF strategy reports, high-quality appearance prototypes
The Beauty of Meaning	Scene and Narrative Construction	User personas, usage scenario storyboards, product concept videos, cultural metaphor design
The Beauty of Intelligence	Interaction and System Integration	System architecture diagrams, user journey maps, low/high-fidelity interactive prototypes, service blueprints
The Beauty of Reflection	Sustainability and Social Responsibility	Simplified Life Cycle Assessment (LCA), Design for Disassembly (DFD) drawings, design ethics statements

3.3.4 Question 4: Practice — How to Complete a "Warm" Conceptual Design for Intelligent Agricultural Equipment?

Intent: Conduct comprehensive application and creation within a real project.

Development: Adopt Project-Based Learning (PBL) centered on the topic "Design a Micro Intelligent Harvesting Assistant for Smallholder Farmers in Hilly Areas." Students are required to: conduct field surveys and user interviews (farming-reading practice); use Kansei Engineering methods to define and translate core impressions like "lightweight, reliable, easy-to-learn"; and, starting from the "Four-Dimensional" capabilities, complete a comprehensive proposal from concept to prototype and from business model canvas to sustainability assessment. Instructors provide support such as a "Kansei Engineering Toolkit" and a "Sustainable Design Checklist" during this process.

3.3.5 Question 5: Sublimation — What Seeds Does This Course Sow for Our Design Careers?

Intent: Foster metacognitive reflection, achieving value internalization and identity formation.

Development: Organize a "Future Designers Salon," inviting industry experts and young farmers to participate. Students present their design schemes to articulate how they embody understanding and respect for farmers and their vision for the land's future. Guide them to recognize that aesthetic education aims not only to create "good-looking" products but, more importantly, to cultivate a design value system that cares for people's livelihoods and acts for good. The sense of responsibility and broader perspective germinated in the classroom will nurture their entire design careers.

3.3.6 "One Extension": Solidifying Outcomes and Social Connection

The course emphasizes the continuity of design outcomes and their translation into social value. Specific approaches include: compiling outstanding design works into portfolios or organizing thematic exhibitions; promoting feasible proposals for participation in relevant innovation and entrepreneurship competitions and exploring potential for results transfer by connecting with agricultural machinery enterprises and agricultural

parks; guiding students to systematically document their project processes and reflections, forming a significant marker of their professional growth. Furthermore, by establishing a course public account, holding design sharing sessions, and other methods, interaction with the industry and the public is enhanced, expanding the social impact of design education.

4. Diversified Teaching Methods and Resource Support

4.1 Project-Based Learning (PBL) and Interdisciplinary Workshops

The course backbone consists of 2-3 progressively challenging PBL projects. During this period, interdisciplinary workshops can be jointly held with majors such as Agricultural Engineering and Computer Science to simulate real product development teams, cultivating students' cross-disciplinary communication and collaboration skills.

4.2 A "Virtual-Physical Combined" Experiential Field

Immersion in the Virtual Realm: Utilize virtual simulation experiment platforms to allow students to safely "operate" large, complex equipment in a virtual environment, understanding their internal structure and operational logic. Use VR technology to "stroll" through digital twin farms, building systemic cognition.

Insight from the Physical Realm: Organize visits to the China Agricultural Machinery Culture Exhibition Hall and modern smart farms. Contemplate the evolution of artifact creation before historical objects, feel the power of technology before modern equipment, and gain the most direct design inspiration in the fields.

4.3 Case Library and Resource Package Development

Build a digital course resource repository containing materials such as "An Illustrated Guide to Traditional Farm Tools," "Global Innovation Cases of Intelligent Agricultural Equipment," and "Application Examples of Kansei Engineering in Agricultural Machinery Design." Concurrently, develop a "Value-Oriented Resource Package" containing teaching aids like short films and articles reflecting the development history of modern Chinese agriculture and the vitality and ethos of contemporary young farmers.

5. Summary of Teaching Innovation Features

5.1 Innovation in Theoretical Approach

Innovatively constructs a ternary-integrated design aesthetic education model of "Kansei Engineering – Farming-Reading Culture – Intelligent-Manufacturing Aesthetics," providing a clear and solid theoretical foundation for conducting design education in fields where technology and the humanities are highly integrated.

5.2 Innovation in Cultivation Mode

Achieves a paradigm upgrade from "knowledge transmission" and "aesthetic appreciation" to "innovation-driven" and "value shaping." The course outputs complete design proposals encompassing user research, cultural reflection, technological integration, and business insight, directly addressing the core goals of design education.

5.3 Innovation in Integration Value

Deeply integrates aesthetic education with quality cultivation. Cultural confidence, national sentiment, and craftsmanship spirit are no longer external impositions but become the intrinsic emotions and rational choices naturally arising as students engage in the design process of understanding users, mastering technology, and contemplating sustainability, truly achieving the effect of "dissolving like salt in water, nurturing silently."

6. Conclusion and Outlook

This paper systematically elaborates on a curriculum reform practice aimed at design majors, deeply integrating aesthetic education with professional education. With "Form, Meaning, Intelligence, and Reflection" as its framework and the "new essence of farming-reading" as its soul, the course, through systematic theoretical construction and meticulous instructional organization, is dedicated to cultivating new-era design talents equipped with "Four-Dimensional" innovative capabilities.

Preliminary teaching practice indicates that this model can effectively enhance students' professional identity, cultural comprehension, and systemic innovative thinking. Future course development can deepen in the following directions: first, developing more refined capability assessment scales to scientifically track the growth and changes in students' design abilities; second, building a more stable "University-Enterprise-Agriculture" collaborative education platform to increase the authenticity of project topics and the potential for result transfer; third, modularizing the course framework to adapt it to other specialized directions such as "Transportation Design" or "Public Facility Design," exploring more pathways for design aesthetic education to serve national strategic areas.

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