THE EVOLUTION OF DESIGN EDUCATION PARADIGMS: RESEARCH ON TALENT DEVELOPMENT FOR AN INTELLIGENT FUTURE

Ranran SUN[1]
[1]Central Academy of Fine Arts, China

ABSTRACT
Against the dual backdrop of cross-disciplinary convergence and intelligent empowerment, foundational design education is undergoing a profound paradigm shift. Drawing upon Kuhn's theory of paradigm shifts, this paper examines the roles and responsibilities of educators in this process through three key concepts: the scientific community, incommensurability, and paradigm transformation. Research reveals that educators, as vital members of the design education community, are not only practitioners of the old paradigm but also drivers of the new one. During this paradigm shift, educators must confront the incommensurability between traditional craft training and intelligence-empowered pedagogy. They must reconstruct their knowledge frameworks and teaching methodologies, guiding students from imitative craftsmanship toward collaborative intelligence creation.

Keywords: Kuhn's Paradigm Theory, Paradigm Shift, Design Education, Intelligence Empowerment

1 INTRODUCTION

Since Thomas Kuhn introduced the concept of the *paradigm* in *The Structure of Scientific Revolutions* as a central notion in the philosophy and sociology of science, it has acquired novel and rich connotations. A paradigm may be understood as the philosophical or theoretical framework of a scientific school or discipline, within which theories, laws, generalizations, and the experiments that support them are systematically articulated. Scientific progress is no longer conceived as a linear and cumulative process, but rather as a cycle of "normal science—crisis—revolution—new paradigm establishment." Kuhn emphasized that scientific activity is organized around the *scientific community*, whose members share common beliefs, values, and research norms that sustain the stability of a paradigm. Yet when an existing paradigm fails to explain new problems, conflicts of *incommensurability* arise within the community, as old and new paradigms lack a shared language in terms of goals, methods, and evaluative standards. The accumulation of such tensions ultimately drives the replacement and reconstruction of paradigms. Paradigm shifts thus signify not only the renewal of knowledge structures but also the transformation of ways of thinking and the reshaping of disciplinary culture.

Design education, likewise, possesses a distinctive paradigmatic character. From its inception, art and design have carried an interdisciplinary orientation. The First Industrial Revolution propelled design beyond the realm of craft, fostering its emergence as an independent field and laying the groundwork for modern design. In 1969, Herbert Simon introduced the concept of "design science," defining it as a synthesis of design philosophy and methodology, thereby providing a foundation for the discipline's development. Over the long term, design foundation education in traditional art academies has evolved into a stable paradigm centered on technical training, emphasizing mastery of basic skills such as form, color, and composition. This paradigm has been effective in shaping students' expressive capabilities, yet its underlying logics of "teacher-centeredness" and "standardized skill assessment" have proven inadequate in addressing the complex demands of contemporary society and industry. In 1993, China's *Agenda 21* incorporated interdisciplinary research activities into national development strategies, further promoting the convergence of knowledge domains. In recent years, "cross-disciplinary integration" has become an important direction of educational reform, with design education gradually incorporating knowledge systems from engineering, sociology, and communication studies, thereby driving curricular and pedagogical innovation. Nonetheless, this transitional paradigm faces clear limitations in the era of

AI and big data-driven "intelligent empowerment." How can the value of traditional skills be preserved in the face of intelligent tools? How can cross-disciplinary integration avoid fragmentation? How can learning objectives shift from singular skill acquisition toward the cultivation of human–AI co-creative capacities? These pressing questions reveal that design education is currently in a paradigmatic dilemma. Against this backdrop, the central research question of this paper is: How can educators, amid the expansion and reconstruction of the scientific community, confront the incommensurability conflicts between old and new paradigms, and thereby facilitate the paradigm shift of design foundation education from cross-disciplinary integration to intelligent empowerment? By drawing upon Kuhn's core theoretical concepts—scientific community, incommensurability, and paradigm shift—this paper seeks to uncover the internal logic of paradigm transformation in design education, offering both theoretical guidance and practical insights for educators in curriculum design, capacity building, and the cultivation of disciplinary communities.

2 THE STRUCTURE AND RECONSTRUCTION OF THE DESIGN EDUCATION COMMUNITY

Kuhn argued that the development of science is inseparable from the scientific community —a group that shares common beliefs, methods, and values, and serves as the foundation for the existence and transmission of paradigms. The formation of a shared worldview within the scientific community is a prerequisite for effective scientific inquiry. As Kuhn emphasized, "For a scientific community, effective research can hardly begin until it has obtained answers to questions such as: What are the fundamental entities that constitute the universe? How do these entities interact with one another? How do these entities relate to sensory experience? What kinds of questions about them are legitimate, and what techniques are appropriate for seeking their answers?" Thus, the scientific community is not only the carrier of knowledge but also the generative environment for research order and methodological norms.

By analogy, the educational development community emerges when educational progress reaches a certain stage and faces the demands of new historical contexts and tasks. In essence, it constitutes a highly specialized and hierarchically structured "society–education system," whose core mission is to provide students with comprehensive, multidimensional educational support through the enrichment and rational allocation of resources. In the field of design education, a comparable community also exists, centered on educators. The shared epistemic orientations and pedagogical practices of this community define the boundaries and connotations of the design education paradigm. In this sense, the evolution of design education can be understood as a process of structural expansion and cognitive reconstruction within the design education community at different historical stages.

Within the traditional academy of fine arts, the design education community was largely composed of educators with backgrounds in visual and plastic arts. They emphasized fundamental training in drawing, color, and composition, thereby establishing a skills-oriented curriculum system. In this community, the educator's role was essentially that of a "craft transmitter," with values anchored in the mastery of manual skills and rigorous formal training. This phase ensured the professionalism and disciplinary independence of design education, but it also entrenched a "skills-centered" epistemology.

With the transformation of society and industry, however, singular technical training could no longer meet the demand for interdisciplinary knowledge and comprehensive competencies. The design education community gradually absorbed researchers and teachers from engineering, information science, sociology, communication studies, and other domains, thereby driving "cross-disciplinary integration" as a new direction in education. In this stage, the educator's role shifted toward that of a "cross-disciplinary integrator," not only teaching skills but also facilitating workshops, project-based learning, and other practices to guide students in addressing complex problems within open contexts. Yet, this emergent cross-disciplinary community also faced internal tensions: disparate disciplinary discourses had not yet formed a coherent integrative logic, leading to fragmentation and methodological pluralism in practice.

In the era of artificial intelligence and big data, the design education community has undergone yet another restructuring. AI developers, educational technologists, design educators, and industry practitioners together constitute a new type of community. Within this context, the educator's role has

further evolved into that of a "human–AI co-creation facilitator." Rather than relying solely on traditional craft instruction, educators must now guide students to leverage generative AI, virtual simulation, and data analysis tools to construct new forms of knowledge and capacity through interaction with intelligent systems. In this model, the educator is not merely a transmitter of knowledge but also a designer of learning processes and a cultivator of cognitive environments.

Table 1. Comparative Stages of Evolution in Design Education Communities (Based on Kuhn's Concept of Scientific Communities)

Stage	Core Content	Challenges and Difficulties	Teacher Role
Phase One: Traditional Art Academy Community	Foundational skills in sketching, color theory, and composition	Skill centralization and lack of cross-disciplinary thinking	Skill Instructor
Phase Two: Cross-Boundary Integration Community	Integration of engineering, information science, sociology, and communication studies into design	Fragmented knowledge and methodologies—diverse yet lacking unified paradigms	Organizer, Coordinator Learning Designer
Phase Three: Intelligent Empowerment Community	Generative AI, virtual simulation, and big data-driven design	Redefining educational value amid technological dependency and ethical risks	Cognitive Environment Facilitator

In sum, the evolution of the design education community reflects a progression from "craft transmitter" to "cross-disciplinary integrator," and ultimately to a stage where human–AI collaboration becomes the new norm and infrastructure of knowledge production in the intelligent media era. This structural expansion and cognitive reconstruction of the community provide the social and academic foundations for paradigm shifts in design education. It can be argued that the transformation of the scientific community itself nurtures the possibility of paradigm change. As the central members of the design education community, educators' evolving role conceptions and practices directly determine whether design education can achieve its transition from cross-disciplinary integration to intelligent empowerment.

3 THE CONFLICT BETWEEN OLD AND NEW DESIGN EDUCATION PARADIGMS

Kuhn argued that scientific revolutions are not the cumulative development of science but rather revolutionary shifts in which a new paradigm replaces an old one. The old and new paradigms, he stressed, are "not only logically incompatible but also incommensurable in practice." Incommensurability means that old and new paradigms lack a shared language in terms of problem selection, methodology, and evaluative criteria, making direct comparison within a single framework impossible. In design education, this incommensurability is particularly evident. With the intervention of intelligent technologies and shifting educational demands, traditional and emerging paradigms clash systematically across educational goals, teaching methods, and evaluation systems. The accumulation of these conflicts has propelled reflection and reform within the educational community. Traditional design education emphasized students' mastery of skills such as drawing, color, and composition, regarding technical proficiency as the prerequisite for entering the field.

Viewed through Kuhn's theory of paradigms, the evolution of design education can be traced across four stages: the period of incidental inquiry, the pre-paradigm stage, paradigm establishment, and paradigm evolution. In the late nineteenth and early twentieth centuries, design education did not exist as an independent discipline but was embedded within art, craft, and architecture. Scholars and educators, often motivated by practice, pursued fragmented explorations of teaching issues. Advocates of the Arts and Crafts movement, for example, underscored the unique artistic value of traditional handmade objects and affirmed the natural beauty embodied in craftsmanship. The Bauhaus sought to establish an interdisciplinary curriculum and embraced the machine as a modern means of form-making, encouraging students to construct a new order of expression and form. Without such an order, the goals of education could not be realized. Merely creating superficial links with craft, without ensuring basic technical training, rendered attempts to enter industry largely meaningless. Hence, this stage lacked a stable disciplinary framework or shared community and can be seen as the incidental inquiry period.

By the mid-twentieth century, modernist design, with its core principle of "design for the masses," emphasized functional value with universal significance. The "Ten Principles of Functionalism" articulated requirements concerning objects, subjects, and purposes, underpinned by scientific rationality and systematic methods, which were viewed as prerequisites for producing "good design." With industrialization and the rise of modernism, design education began to form a unified foundational curriculum. Courses in drawing, color, and composition became standard, emphasizing both formal rationality and technical training. During this period, multiple educational ideologies coexisted—most notably functionalism, the dominant design paradigm of the twentieth century, rooted in the humanist worldview of modernism. Yet no single approach became absolutely dominant, marking this stage as the pre-paradigm period.

From the late twentieth century into the early twenty-first, design education gradually solidified a stable paradigm centered on technical mastery. This "craft paradigm" emphasized students' skills in form, color, and composition, while teachers assumed the role of "craft transmitters." Within this disciplinary community, consensus was reached on curriculum, methods, and assessment, constituting Kuhn's notion of normal science. At this stage, design education exhibited strong disciplinary boundaries and stability.

In the twenty-first century, under the pressures of globalization, informatization, and interdisciplinarity, design education entered a phase of cross-disciplinary integration. The educational community absorbed resources from engineering, information science, sociology, and communication studies, driving curriculum and pedagogical reform. Educators became "cross-disciplinary integrators," operating in new interdisciplinary communities that sought to transcend conventional paradigms, academic networks, and collective logics, enabling the reinterpretation and reinvention of knowledge. Nevertheless, this paradigm remained tethered to the framework of the craft tradition. Integration often became fragmented, leaving the deeper demands of society unresolved.

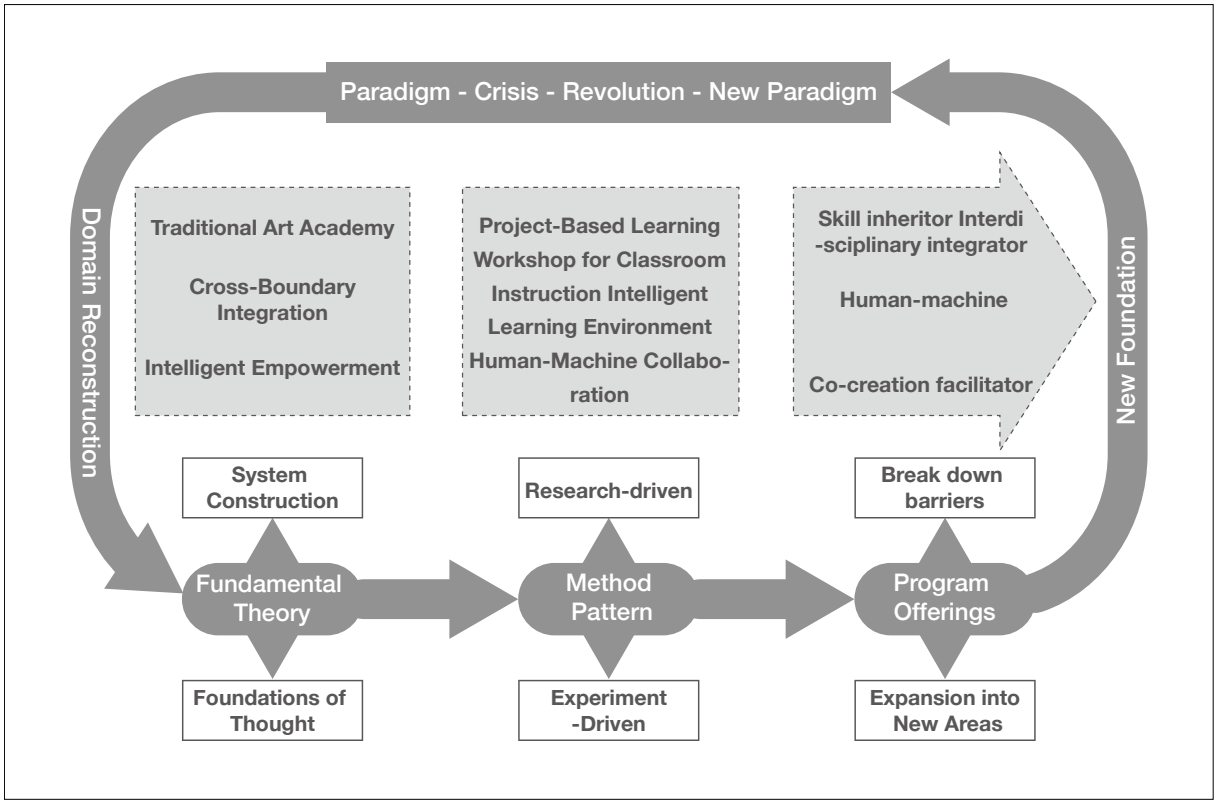

Figure 1. Paradigm Shift Logic Diagram

With the arrival of the intelligent empowerment era, technologies such as generative AI, big data, and virtual simulation presented new challenges and opportunities for design education. Traditional craft paradigms, in terms of goals, methods, and evaluation, proved incommensurable with the logic of intelligent tools, creating crises within the educational community. These crises, however, laid the

groundwork for paradigm transformation, gradually steering design education toward a new paradigm centered on human–AI co-creation.

Within this new paradigm, educational objectives shift toward cultivating generative thinking and collaborative capacities with intelligent systems. AI can instantly generate countless visual alternatives, meaning technical proficiency alone is no longer students' core competitive edge. Educators must therefore guide students in critically selecting, interpreting, and transforming AI-generated outputs. This difference in objectives underscores the fundamental divergence between old and new paradigms. Traditional methods emphasized copying, repetitive practice, and teacher-centered instruction to ensure uniform standards of skill. In contrast, intelligent empowerment emphasizes exploratory, interactive, and learner-centered approaches. Students use AI to rapidly iterate sketches, while teachers foster comparative analysis, critical judgment, and concept generation.

In this context, educators are no longer the sole source of techniques but become designers of learning processes and facilitators of critical thinking. The lack of common ground between old and new methods requires constant pedagogical adaptation. Traditional evaluation emphasized standardized results—accuracy of line, harmony of color, and completeness of composition—anchored in outcome-oriented logic. By contrast, the intelligent paradigm emphasizes process: creativity, criticality, and human–AI collaboration. Assessments focus on how students refine AI-generated results, integrate technology with design thinking, and demonstrate innovation. This reorientation reveals incommensurability at the level of assessment as well, compelling educators to reconstruct evaluative frameworks.

Caught between paradigms, educators face a dual challenge. On the one hand, they must preserve the value of traditional craft training to avoid reducing education to dependency on intelligent tools; on the other hand, they must embrace the demands of the new paradigm, cultivating students' integrative abilities in intelligent contexts. This tension manifests not only in curricular content but also in the redefinition of the educator's role: they remain guardians of traditional skill yet must also become guides to new epistemologies.

The incommensurability between old and new paradigms thus illuminates the deeper contradictions driving design education's transformation. Goals, methods, and evaluative systems cannot coexist under a single logic. For educators, this contradiction is both a dilemma and an opportunity. Incommensurability forces educators to rethink their pedagogical roles and disciplinary positioning, thereby creating the conditions for paradigm transformation. In this sense, the conflicts and incompatibilities between old and new paradigms constitute the internal impetus for design education's evolution toward intelligent empowerment.

4 DESIGN EDUCATION: FROM CROSS-BOUNDARY INTEGRATION TO INTELLIGENT EMPOWERMENT

Kuhn argued that scientific development is not a linear accumulation but rather the result of crises and contradictions culminating in paradigm shifts". The transition from one paradigm to another through a revolutionary break is, in fact, the common pattern of mature science. When sustained anomalies emerge and old paradigms fail to provide adequate explanations, new paradigms inevitably take shape.

In design education, the traditional craft-oriented paradigm and the transitional paradigm of cross-disciplinary integration once met educational needs in specific historical stages, but both have shown limitations in the context of an intelligent society. The expansion and restructuring of the educational community, coupled with the incommensurability between old and new paradigms, have ultimately driven design education toward a new paradigm centered on "intelligent empowerment".

Cross-disciplinary integration was initially viewed as an effective solution to the shortcomings of craft-based education. By incorporating knowledge from engineering, information science, and the social sciences, design education broadened its disciplinary boundaries. Educators were no longer limited to skill transmission but sought to cultivate students' comprehensive capacities. However, with the rapid development of artificial intelligence and big data, two problems have become apparent. First, genuine

interdisciplinarity requires optimal alignment of knowledge, methods, thinking, and resources across fields to address complex, multi-domain problems. In practice, integration has often remained superficial, lacking systematic depth and stability. Second, while interdisciplinary knowledge has expanded students' horizons—linking art, engineering, and information technology—this breadth of knowledge has not been sufficient to meet the entirely new capacity demands of the human–AI collaboration era. For instance, students may understand the principles of AI or methods of data visualization, yet often lack the ability to effectively interact with intelligent systems, engage in generative co-creation, or make ethical judgments in practice. These limitations have led educators to realize that stitching together disciplinary knowledge cannot, by itself, cultivate the critical thinking and integrative practice required in intelligent environments. Thus, design education must move from "cross-disciplinarity" to "cross-cognition", focusing not only on knowledge integration but also on fostering human–AI collaboration, systems thinking, technological sensitivity, and reflective values.

Kuhn observed that paradigm shifts are essentially changes in the metaphysical foundations of cognition and transformations in the entire structure of knowledge and belief. When crises cannot be resolved within existing frameworks, the revolutionary phase of paradigm change is triggered. In design education, this revolution manifests in educators' active adoption of intelligent technologies and their restructuring of curricula and pedagogy. For example, many current applications rely on AI-generated content (AIGC) technologies, which evolve from a combination of professionally generated content (PGC) and user-generated content (UGC), and are driven largely by Generative Adversarial Networks (GANs). Generative AI has been integrated into foundation courses for sketch generation and compositional exploration; VR and AR technologies have been applied to spatial training and interactive design; and data analytics tools have been used for user research and design validation. In this process, educators' roles have undergone a profound transformation: they are no longer merely "craft transmitters" or "interdisciplinary integrators", but have become "facilitators of human–AI co-creation", guiding students toward new epistemologies and design methodologies through the use of intelligent tools.

As intelligent technologies are embedded more deeply into design education, a new paradigm of "intelligent empowerment" is taking shape. This paradigm is characterized by three major transformations:

1. Shifts in curricular goals : from skill mastery to the cultivation of generative thinking, critical judgment, and human–AI collaboration. Generative thinking requires students to transcend existing paradigms and explore possibilities with intelligent tools. Critical judgment emphasizes the ability to discern and select valuable outcomes amid redundancy and automatic generation. Human–AI collaboration requires an understanding of AI's logic, boundaries, and ethical implications, enabling students to complement and co-evolve with technology. Accordingly, the focus of design education is shifting from a "skill-centered" to a "thinking- and collaboration-centered" orientation.

2. Innovation in teaching methods : from teacher-centered training to exploratory, personalized, and interactive learning supported by intelligent systems. The traditional teacher-centered model, while effective in ensuring skill mastery, is limited in addressing complex problems under intelligent conditions. With the rise of generative AI and intelligent learning systems, higher education is moving toward a triadic "teacher–machine–student" structure. Students can engage in exploratory learning, pursue personalized paths, and build knowledge collaboratively with peers, teachers, and AI. This shift enhances student initiative and creativity while transforming teachers from "authoritative knowledge transmitters" into "learning facilitators" and "intelligent collaborators."

3. Reconstruction of evaluation systems : from outcome-oriented skill standardization to process-oriented creativity and human–AI co-creation. Traditional evaluation emphasized completion and standardization of skills while neglecting the value of exploration and iteration. In the human–AI co-creation era, assessment focuses on students' exploratory and iterative processes, their ability to reframe and refine AI-generated outputs, and their integration of technological tools with design thinking. This

process-oriented evaluation highlights the experimental and open-ended nature of design, fostering creativity and critical capacity in complex contexts.

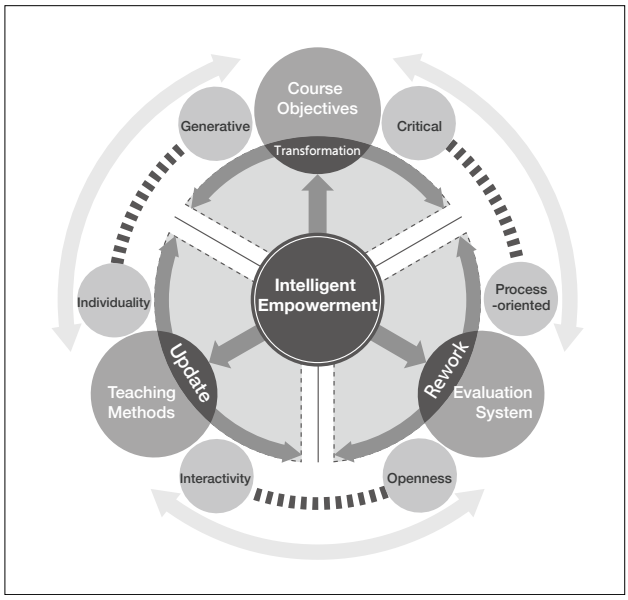

Figure 2. Designing a New Paradigm for Intelligent Empowerment in Education

In summary, the transformation of design education extends beyond superficial curricular updates to encompass a systematic reconstruction of goals, methods, and evaluation mechanisms. This triple-pathway transformation not only responds to the demands of human–AI co-creation but also redefines the value orientation of design education for the future. Within this new paradigm, educators bear the responsibility of redesigning learning environments and tasks, enabling students to cultivate unique creativity and value judgments through interaction with intelligent systems.

The paradigm shift in design education is thus driven by the logical chain of "scientific community—incommensurability—paradigm shift." The expansion and restructuring of the educational community provide fertile ground for new paradigms; incommensurability reveals the limitations of old paradigms and the crises they accumulate; and paradigm transformation, initiated by educators, establishes intelligent empowerment as the new dominant mode. This chain demonstrates that the evolution of design education is not merely a matter of updating tools and methods but represents a wholesale reshaping of community cognition and disciplinary culture.

The paradigm shift in design education is therefore not accidental but the inevitable result of the evolution of the educational community and the conflicts of incommensurability. Educators are the central actors in this process: through curriculum reconstruction and role transformation, they drive the transition from cross-disciplinary integration to intelligent empowerment. Looking ahead, as human–AI co-creation becomes the new normal in design, educators must continually explore innovative pedagogies and evaluation systems within the framework of intelligent empowerment to sustain the foresight and creativity of design education.

CONCLUSIONS

This paper employs Kuhn's theory of paradigm shifts as its analytical framework, exploring the evolutionary logic of design education from craft-oriented approaches to cross-disciplinary integration and ultimately to AI-empowered practices. The study demonstrates that the paradigm shift in design education possesses historical inevitability:

The expansion and restructuring of scientific communities laid the groundwork for paradigm evolution. From the craft-based communities of traditional art academies, to interdisciplinary knowledge-integrated communities, and finally to intelligence-empowered communities operating in human-machine collaboration, educators have consistently been the core driving force behind community evolution. The conflict of incommensurability between old and new paradigms reveals the inherent tension of transformation. The incompatibility between the traditional craft paradigm and the

intelligence-empowered paradigm in terms of objectives, methods, and evaluation systems compels educators to confront and resolve contradictions within teaching practice. This incommensurability is not passive resistance but the driving force behind paradigm shift. The realization of paradigm transformation embodies educators' proactive agency. It is precisely through educators' practical actions in curriculum restructuring, tool integration, and pedagogical innovation that design education has transitioned from cross-disciplinary convergence to intelligent empowerment, forming a new paradigm centered on generative thinking, human-machine co-creation capabilities, and process innovation.
Looking ahead, design education will continue to encounter new challenges and opportunities: First, educators must reconstruct curricula within the framework of intelligent empowerment, ensuring a balance between technical training and the use of intelligent tools. Second, evaluation mechanisms aligned with human-machine co-creation logic should be explored to transcend the limitations of traditional skill-oriented approaches. Third, efforts must be made to foster cross-regional, interdisciplinary educational communities, cultivating a more open and shared design education ecosystem.

In essence, the paradigm shift in design education represents not merely an update of tools and methods, but a fundamental reshaping of educators' knowledge perspectives and role perceptions. Future educators must evolve beyond being guardians of craftsmanship and integrators across disciplines to become guides for human-machine co-creation in the intelligent era. This transformation will ensure design education maintains vitality and foresight under the new paradigm.

REFERENCES

[1] Drucker, J. W., and Teng, X. B. Ethics vs. aesthetics: design criticism from the perspectives of fu nctionalism and postmodernism (Part 1). *Zhuangshi (Decoration)*, 2012, (1), 52–59.
[2] Gropius, W., and Feng, G. T. The ideas and structure of the Bauhaus. *New Fine Arts*, 2020, 41(4), 4–15.
[3] Hu, L. F., and Lu, H. Interdisciplinary communities and their construction. *University and Discipl ine*, 2025, 6(1), 35–46.
[4] Jin, W. L. Translator's postscript. In T. S. Kuhn, *The Structure of Scientific Revolutions*, 2003, p. 199. Beijing: Peking University Press.
[5] Kong, D., and Xu, C. Y. The British Arts and Crafts Movement and its contemporary implication s. *Fine Arts*, 2017, (5), 120–125.
[6] Kuhn, T. S. *The Structure of Scientific Revolutions*. J. W. Lun and H. X. He (trans.). Beijing: Peki ng University Press, 2003.
[7] Kuhn, T. S. The first use of the term "paradigm." *Journal of Dialectics of Nature*, 2005, (4), 105–107.
[8] Lin, F., Mao, N. X., and Yu, Z. H. Visualization analysis of research on art and design education i n universities based on bibliometrics. *Packaging Engineering*, 2024, 45(S1), 481–488.
[9] Liu, Y. L. Exploration of the construction of special education development communities in the n ew era. *Theory and Practice of Education*, 2025, 45(11), 24–27.
[10] Pu, Z. H., and Yang, B. Research on the application of AI-assisted technology in packaging desig n. *Packaging Engineering*, 2023, 44(12), 273–281.
[11] Wang, C. L., and Cao, R. P. Rethinking functionalist design: from J. W. Drucker's "Ten comman dments of functionalism." *Art Observation*, 2024, (3), 66–67.
[12] Wen, J. Y., and Wang, W. Y. The practical dimensions and ethical limits of intelligent empower ment in higher education teaching and learning. *Higher Education Development and Evaluation*, 2024, 40(5), 92–104, 123–124.
[13] Wu, M. C. *Paradigms of Educational Technology Research in China*. Doctoral dissertation, Jiang su Normal University, 2012.
[14] Zhang, R. F., Tian, L. C., and Ma, Z. Q. Cultivating teachers' design thinking in the intelligent er a: logical dimensions and solutions to dilemmas. *China Distance Education*, 2022, (4), 55–64.
[15] Zhang, W. C., and Chen, M. R. The value implications, orientations, and implementation paths of interdisciplinary integration. *Theory and Practice of Education*, 2023, 43(29), 3–7.
[16] Zhong, J. Q. Human–machine collaborative content production model. *Young Journalist*, 2020, (36), 44–45.