A PRACTISE OF A CREATIVITY-CENTERED PEDAGOGICAL MODEL FOR CHINESE DESIGN EDUCATION

Yufan Zheng

Canterbury Christ Church University

Anne Nortcliffe

Faculty of Arts, Computing, and Engineering, Wrexham University

Stuart Lambert，Hany Hassanin

School of Science, Psychology, Arts and Humanities, Computing, Engineering and Sport, Canterbury Christ Church University

ABSTRACT

Based on a doctoral research project on pedagogical innovation in higher design education for Generation Z in China, this paper examines how international exemplary educational models can be effectively integrated and localized within the Chinese educational context. An innovative teaching framework was researched, developed, verified and validated to meet the needs of Chinese design education in the study. The approach cultivated student's creativity as its central goal, the research integrates international advanced educational theories such as interdisciplinary teaching, CDIO framework and student-centered pedagogy. Also, aligned the student learning experience with the characteristics of China's education system and societal development needs. The resulting framework is systematic, structured, and highly adaptable, aiming to promote students' comprehensive development in creativity, critical thinking, collaboration, application ability, communication, and social responsibility through the integration of interdisciplinary knowledge and project-based practice. Drawing on students' learning process experiences and self-evaluations, this paper evaluates the proposed teaching model and examines the adaptability of the CDIO approach in design education within the Chinese context.

KEYWORDS

Chinese higher education, interdisciplinary learning, project-based learning (PjBL), CDIO implement, Standards: 2, 3, 8

RESEARCH OVERVIEW

In the context of the deep convergence of globalization and digitalization, design education is undergoing profound systemic and structural transformation. The rapid evolution of global economic forms, scientific and technological advancement, and social demands has imposed increasingly complex and multidimensional requirements on the competency structure of design professionals. Contemporary designers are expected not only to possess solid professional knowledge and technical skills, but also to demonstrate systems thinking, interdisciplinary integration, and sustained capacities for creativity and practice within real and complex contexts, alongside a strong sense of responsibility toward society, culture, and sustainable development (Buchanan, 1992; Cross, 2006).

Although Chinese design education has gradually shifted toward a competency-oriented paradigm, moving beyond traditional skill-based training toward educational models that emphasize comprehensive capability development and authentic learning contexts (Ministry of Education of the PRC; Xie et al., 2021), the learning experiences of many Chinese students have still largely been shaped by lecture-oriented and assignment-driven instructional models (Biggs, 1996). In such environments, knowledge transmission and individual task completion often occupy a central position in classroom activities. While this approach supports the development of disciplinary foundations, it may provide limited opportunities for open-ended exploration, collaborative problem-solving, and experiential learning. Consequently, students may initially encounter challenges when adapting to project-based and student-centred learning environments.

In this study, creativity is understood as the capacity for problem discovery and problem solving within authentic contexts. Rather than focusing solely on the generation of novel ideas, creativity in design education also involves the ability to identify meaningful problems, frame design opportunities, and develop viable solutions through iterative processes (Runco & Jaeger, 2012; Sawyer & Henriksen, 2024).

From a pedagogical perspective, creativity development is often supported through experiential learning, interdisciplinary knowledge integration, and collaborative problem-solving environments (Amabile, 2018). Previous studies in design education have suggested that project-based learning, studio-based learning, and interdisciplinary curricula can provide meaningful contexts for students to develop creative and professional competencies (Lupton & Miller, 1991; Visser, 2010). Meanwhile, the CDIO framework provides a structured educational approach that aligns well with these pedagogical principles. Through the “Conceive-Design-Implement-Operate” cycle, the framework integrates disciplinary knowledge, professional skills, and experiential learning processes. In particular, the pedagogical design of this course corresponds to several CDIO standards, including integrated curriculum development (Standard 3), active learning strategies (Standard 8), and the development of personal and professional competencies (Standard 2).

Within this context, the teaching experiment reported in this paper was conducted at an University in China, with the research framework supported by Canterbury Christ Church University in the United Kingdom. Based on students’ classroom performance and post-course questionnaire and interviews feedback, this study examines how international pedagogical frameworks can be adapted to the Chinese higher design education context. The research aims to explore how creativity-oriented design pedagogy can be implemented through interdisciplinary learning environments and CDIO framework, while generating insights that may inform broader innovation-driven curriculum development.

RESEARCH METHODOLOGY

This study adopts pragmatism as its overarching philosophical paradigm. Pragmatism supports multi-method integration and results-oriented inquiry, emphasizing the practical use of knowledge (Morgan, 2007). This orientation aligns closely with the core aim of the study, which is to develop and validate an innovative teaching model within the context of Chinese higher design education to effectively cultivate students' creativity and comprehensive design literacy.

In the research process, the researcher participated fully in the teaching practice through multiple methods, including student questionnaires, student interviews and participatory observation to class, to comprehensively collect multidimensional feedback during the implementation of the teaching model. The questionnaire was administered offline using a six-point Likert scale, and all responses were collected anonymously to encourage honest and unbiased feedback. To further reduce potential bias, several items were designed as reverse-scored questions. Student interviews were conducted by a third party to minimise the influence of the researcher on participants' responses. The interviews were subsequently transcribed and anonymised before analysis to ensure confidentiality. In addition, classroom observations were carried out throughout the course. All observational records were processed with identity masking to avoid identifying individual students. These measures ensured ethical compliance and enhanced the reliability and validity of the collected data.

This triangulated design enhances the validity of educational research findings, as recommended by Creswell and Cohen (Creswell & Creswell, 2017). The study has obtained formal ethics approval from the Canterbury Christ Church University Ethics Review Committee in the United Kingdom and the Communication University of China Nanjing where the experimental course was implemented. All research participants were fully informed of the purpose, procedures, and confidentiality principles of the study before participation. The entire research process strictly adhered to the ethics of educational research, ensuring participants' rights to informed consent, privacy, and voluntary participation.

This paper primarily evaluates the effectiveness of the experimental course through an in-depth analysis of students' learning practices and multidimensional post-course feedback.

THEORETICAL SUPPORT

The theoretical foundation of this study draws on perspectives from the cross-cultural development of design education, which emphasise that educational reforms should be understood within their specific sociocultural contexts rather than being transferred directly across systems (Steiner-Khamsi, 2004). In China, the evolution of design education reflects broader historical and cultural influences. Earlier models were shaped by craftsmanship traditions and ideological education, while more recent reforms have gradually shifted toward approaches that emphasise interdisciplinary integration, systems thinking, and creative practice (Li, 2021). At the same time, Chinese educational practices continue to be influenced by Confucian learning traditions that value discipline, respect for teachers, and knowledge transmission, as well as by socialist educational ideals emphasising collective responsibility and social development (Zhang 2017; Zhao, 2019).

These cultural and institutional conditions shape how international pedagogical models are interpreted and implemented within Chinese higher education. In particular, the introduction of student-centred and project-based pedagogies may require adaptation, as students often transition from lecture-based learning environments toward more open and collaborative learning structures.

Building on this theoretical perspective, the curriculum model developed in this study consists of three interrelated components: interdisciplinary knowledge integration, project-based practice structured through the CDIO framework, and student-centred pedagogy embedded throughout the learning process.

Interdisciplinary knowledge integration aims to expand students’ cognitive perspectives by connecting knowledge from multiple domains, such as design, social sciences, and cultural studies. Such integration supports systems-level understanding and enables students to approach design problems from broader social and contextual perspectives.

Project-based practice in this model is organised according to the CDIO framework. Through the learning cycle of “Conceive-Design-Implement-Operate”, students engage in authentic design projects that integrate conceptual thinking, technical development, and real-world application. This approach corresponds to several CDIO standards, particularly integrated curriculum design (Standard 3), active learning methods (Standard 8), and the development of personal and professional competencies (Standard 2), thereby supporting the cultivation of both creative and practice-oriented capabilities (Edström & Kolmos, 2014).

PEDAGOGY FRAMEWORK

Course framework

The curriculum model developed in this study aims to cultivate students’ critical thinking, interdisciplinary integration, and sustained capacities for creativity and practice through a structured teaching framework. The course combines interdisciplinary knowledge integration with project-based learning organised within the CDIO framework, forming a learning environment in which theoretical exploration and practical experimentation continuously reinforce each other.

The course is organised into two sequential stages which can be seen in figure 1.

The first stage focuses on interdisciplinary lectures and discussions designed to broaden students’ cognitive perspectives and stimulate creative thinking. Design education research emphasises that interdisciplinary exposure can significantly enhance students’ innovative capacity and systems thinking by enabling them to approach design problems from multiple knowledge domains (Rong et al., 2025).

The course is organised around the core theme of “Memory”. Using an abstract and conceptually rich theme encourages students to engage in deeper analysis and interpretation while transcending disciplinary boundaries (Manovich, 2002; Norman, 2007). Eleven interdisciplinary lectures were delivered by scholars from different fields–including architecture, sociology, psychology, literature, biology, medicine, economics, philosophy, pedagogy, drama and film, and computer science. These lectures introduced diverse perspectives on memory, ranging from spatial narratives and collective identity to neurological mechanisms and digital technologies. Following each lecture, students engaged in guided discussions and completed reflective journals to consolidate their learning. This process supported the gradual construction of interdisciplinary connections and provided a conceptual foundation for the subsequent design projects.

The second stage centres on project-based learning implemented through the CDIO framework. Students work in groups to investigate real-world issues related to the theme of memory and develop innovative game-based solutions. The design process follows the CDIO learning cycle:

Conceive (C): Students analyse design problems and contextual knowledge to develop initial game concepts and conceptual design frameworks.

Design (D): Students refine the concepts and translate them into structured game mechanics and design plans.

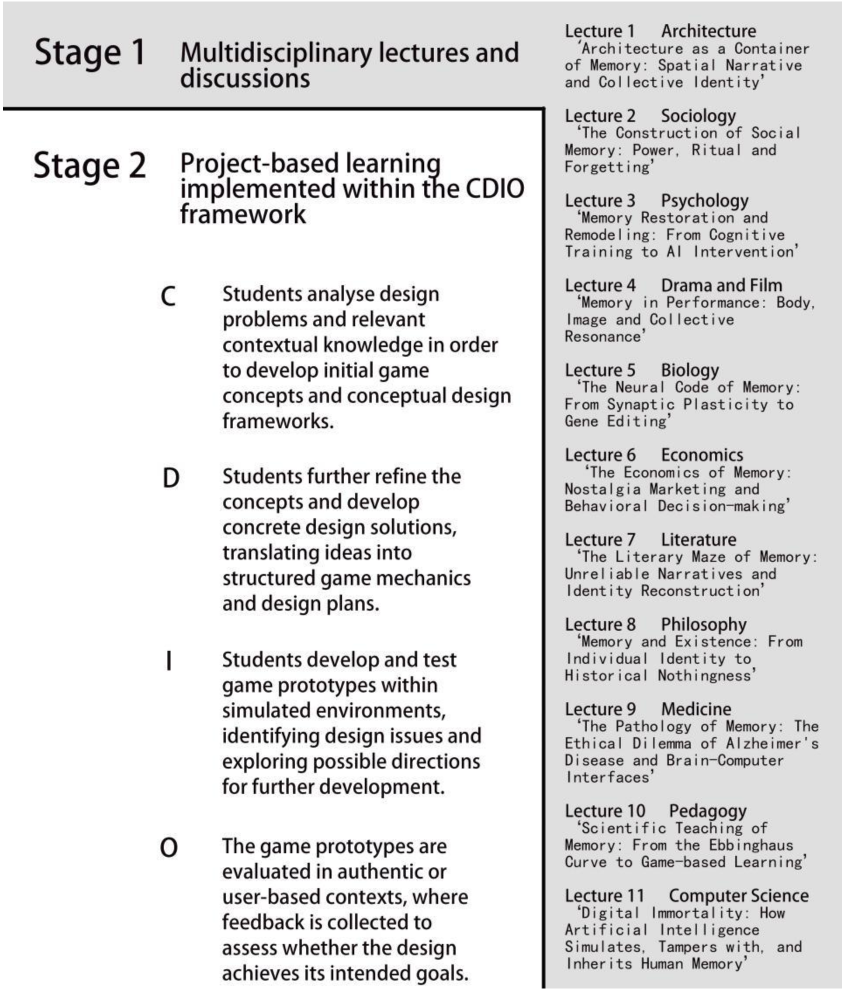
Implement (I): Students develop and test game prototypes within simulated environments, identifying design issues and exploring directions for improvement.

Operate (O): Game prototypes are evaluated in authentic or user-based contexts where feedback is collected to assess whether the design achieves its intended goals.

Each group is required to develop a playable game prototype addressing a specific issue related to memory. The prototypes undergo iterative testing and refinement before culminating in a final game artefact.

Through this process, students apply interdisciplinary knowledge and design thinking to analyse complex problems, generate solutions, implement design ideas, and continuously improve their work through iterative development. The learning process therefore supports the development of critical reflection, collaborative problem solving, creative thinking, and engagement with authentic design practice.

Figure 1. The two stages of course framework



Grouping mechanism

The course adopts a two-stage grouping mechanism. In the first, self-directed learning stage, students freely form groups based on their interests during interdisciplinary lectures and discussions. This open structure fosters autonomous exploration, knowledge construction, and communication skills, laying the groundwork for diverse perspectives and innovative ideas in the subsequent project-based phase. In the second, design-oriented stage, the instructor assigns structured teams of four to five students according to their prior performance and disciplinary strengths, ensuring complementary skill sets. This arrangement supports students throughout the full process from "Conceive-Design-Implement-Operate", reinforcing the systematic progression of tasks and enabling the efficient transformation of concepts into deliverable outcomes.

Assessment system

The course assessment system emphasises process-oriented and reflective learning, aligning with the iterative nature of design practice and the competency development goals highlighted in the CDIO framework. Rather than focusing solely on the final outcome, the assessment also evaluates students' learning performance throughout the entire project development process.

The final grade combines formative and summative assessment, accounting for 60% and 40% of the total grade respectively. The formative assessment consists of six components corresponding to key stages of the project development process, including concept development, design planning, prototype implementation, iterative refinement, testing and evaluation, and reflective learning. These assessments are conducted continuously through instructor feedback, group discussions, and prototype reviews. Feedback generated at each stage provides students with clear and actionable directions for improvement. Drawing on iterative, multi-source feedback, students continuously refine their design solutions by revising concepts, improving technical implementation, and enhancing user interaction. The final project outcome constitutes the summative assessment component. This evaluation approach not only examines the quality of the final game product but also assesses students' engagement in design iteration, problem-solving, and critical reflection throughout the development process.

The assessment methods integrate instructor evaluation, peer assessment, and self-assessment, forming a multi-source feedback mechanism that enhances transparency and fairness in the evaluation process. This assessment structure encourages students to reflect on teamwork processes and individual contributions, thereby promoting the development of communication skills, collaboration, and a sense of responsibility (Nortcliffe et al., 2022), which are also the core competencies emphasized in the CDIO framework.

MODEL IMPLEMENTATION AND REFLECTION

This course was part of the Integrated Product Design program within the Art and Technology major at the Communication University of China Nanjing, and is a compulsory module for fourth-year students in the same major. The implementation of this course was approved by the university' s ethics review committee. All participating students were fully informed about the course and research procedures and participated voluntarily, with the right to withdraw at any time.

The course includes about twelve weeks of classroom instruction followed by four weeks of independent study. The experimental class used in this research is a naturally formed cohort, ensuring the generalizability of the findings. All students were admitted through the standard progression from general secondary education to higher education and had completed three years of full-time undergraduate study prior to participating in the course. This relatively homogeneous educational background provides a consistent basis for evaluating the effectiveness of the teaching intervention. Based on the course implementation and student interviews, this paper analyzed the progression of students' learning. The results show a clear developmental pattern: students moved from initial unfamiliarity and uncertainty to increasing engagement and adaptation, and ultimately to active exploration and creative production. Throughout the project, they exhibited notable growth in learning, creativity, and overall design competence.

In the early stages of the course, students showed low familiarity with the course content and learning approach, accompanied by limited willingness to participate. This pattern was evident both during the initial interdisciplinary lecture phase and at the beginning of the second-stage project collaboration. Such phenomena are consistent with the characteristics of the initial stage of the learning curve, which is marked by high uncertainty and low performance (Anderson, 2005). As one student reflected to the question “How would you evaluate your performance in this course?”:

> “At the beginning, I really did not adapt well to this learning approach. I did not know what I was supposed to do, and the teacher did not give us very specific task requirements.”

As the course progressed, students gradually developed an understanding of the course structure and learning logic, and began to adjust their learning strategies more autonomously by actively seeking information and engaging in discussions. As another student noted in the same question:

> “If I did not actively expand the knowledge needed for learning, it was hard to keep up with the course and participate in group discussions, so I started to explore areas I was interested in after class.”

This transition reflects a shift from externally regulated learning toward internalized motivation, aligning with self-determination theory (Deci & Ryan, 2013), and also resonates with Rogers (2003)’ diffusion of innovations model, which describes the progression from resistance to acceptance.

In terms of teamwork, the quality of group collaboration improved markedly following adjustments to grouping strategies and assessment mechanisms. In the early phase, some groups experienced unclear task allocation and uneven participation, with one student stating:

> “At the beginning, the group organization was quite chaotic, and some group members did not really participate.”

After the introduction of peer assessment and rotating leadership roles, students’ sense of responsibility and willingness to communicate increased significantly. As one student explained in question “To what extent did group-based learning in this course contribute to your personal and professional development?”:

> “I became clearer about which part I was responsible for and more willing to join discussions, and I also realized the importance of teamwork.”

These changes support team learning theory, which emphasizes the role of feedback and accountability in effective collaboration (Senge & others, 1990), and also indicate the development of students’ self-regulated learning abilities (Zimmerman, 2002).

Students also improved in time management and learning organization. Early in the course, they lacked systematic planning and often relied on last-minute work. Through iterative project tasks and continuous feedback, they gradually formed more efficient working habits, consistent with habit formation theory and evidence that project-based learning strengthens self-management (Lally et al., 2010).

Regarding the development of students’ personal competence and creativity, students gradually developed more effective learning habits, interdisciplinary ways of thinking, and authentic project-based experience. Students reported a shift from “rushing to complete tasks close to the deadline” to “breaking tasks down, setting schedules, and continuously reflecting and adjusting during the process,” highlighting the positive role of project-based learning in fostering time management and self-management skills (Lally et al., 2010). At the same time, students demonstrated the ability to transfer and integrate interdisciplinary knowledge in their design practice. As one student remarked in the question “What do you think you gained from participating in this course?”:

> “Memory is not only a personal experience but can also be understood at social and cultural levels.” which was subsequently translated into design decisions, such that “design was no longer just about making something visually appealing.”

This process illustrates the core value of project-based learning under the CDIO framework, where repeated cycles of conceiving, designing, implementing, and operating promote originality and integrated competence through authentic learning experiences.

QUESTIONNAIRE RESULTS AND CONCLUSION

The post-course questionnaire employed a six-point Likert scale for measurement and analysis. To minimise response bias and enhance data reliability and validity, several items were randomly designed as reverse-scored questions, and some statements were intentionally phrased in reverse to reduce mechanical responding and encourage more careful responses. The scale ranged from 1 (strongly disagree) to 6 (strongly agree).

All 36 student questionnaires were returned and considered valid for analysis. The result of questionnaire see Table 1 shows that students responded very positively to the experimental course. Most expressed strong satisfaction with the teaching quality, course structure, learning experience, and instructional organization, noting that the content was clear, well-structured, and engaging, and that the overall experience surpassed previous courses. In self-assessments, students widely recognized the course's impact on enhancing creativity, critical thinking, and interdisciplinary understanding, viewing the design of the module as both innovative and practical in supporting their overall development. Although the questionnaire revealed some differences in perceived challenge, autonomy, and gains in reflection and communication, these variations were largely linked to individual learning styles rather than negative evaluations. Overall, students affirmed the high quality of the course and its positive, lasting influence on creative design thinking and comprehensive competence.

Table 1. The table of the mean values of each category in the questionnaire

Category Mean Value	N	Mean Value	Std
Teaching on the course	36	5.24	0.63
Learning opportunities	36	5.16	0.50
Assessment and feedback	36	5.10	0.85
Organization and management	36	4.81	0.89
Student voice	36	5.17	0.78
Personal development	36	5.43	0.66
Overall satisfaction	36	5.06	1.1
Employability and skills	36	4.86	1.1

Post-course student questionnaires and in-class observations indicate that the experimental course successfully established a coherent teaching framework suited to the Chinese educational context. By integrating interdisciplinary knowledge development with real-world projects, the curriculum effectively enhanced students’ interdisciplinary thinking, collaborative awareness, practical project experience, and reflective abilities as key components of comprehensive talent development.

The strong alignment between the theoretical framework and empirical evidence further supports the feasibility of localizing international design education paradigms in China. The study also confirms that the CDIO framework, originally developed for engineering education, can be successfully extended to design education, offering valuable support for innovation in contemporary higher education.

Overall, this research offers an innovation-driven pathway for advancing the reform and modernization of design education in China and contributes valuable insights into how international educational theories can be adapted and expanded across different cultural contexts.

ACKNOWLEDGEMENTS

The author(s) received no financial support for this work.

THE REFERENCE SECTION

Amabile, T. M. (2018). *Creativity in context: Update to the social psychology of creativity*. Routledge.

Anderson, J. R. (2005). *Cognitive psychology and its implications*. Macmillan.

Biggs, J. B. (1996). Western misconceptions of the Confucian-heritage learning culture. *The Chinese Learner: Cultural, Psychological and Contextual Influences*, 45–67.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, *8*(2), 5–21.

China, E. M. of the P. R. of. (2020). *National Medium- and Long-Term Education Reform and Development Plan (2010–2020).*

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Cross, N. (2006). *Designerly ways of knowing*. Springer.

Deci, E. L., & Ryan, R. M. (2013). *Intrinsic motivation and self-determination in human behavior*. Springer Science \& Business Media.

Edström, K., & Kolmos, A. (2014). PBL and CDIO: complementary models for engineering education development. *European Journal of Engineering Education*, *39*(5), 539–555.

Lally, P., Van Jaarsveld, C. H. M., Potts, H. W. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*, *40*(6), 998–1009.

Lupton, E., & Miller, J. A. (1991). *ABC's of the Bauhaus:: The Bauhaus and Design Theory* (Vol. 5). Princeton Architectural Press.

Manovich, L. (2002). *The language of new media*. University of Toronto Press.

Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, *1*(1), 48–76.

Norman, D. (2007). *Emotional design: Why we love (or hate) everyday things*. Basic books.

Nortcliffe, A. L., Parveen, S., & Pink-Keech, C. (2022). Statistically, does peer assisted learning make a difference on a UK engineering degree programme? HETL Scotland 2017. *Journal of Applied Research in Higher Education*, *14*(1), 489–506.

Rogers, E. (2003). *Diffusion of Innovations 5th*. Free press.

Rong, G., Chen, Y., Ma, F., & Koch, T. (2025). 40 Years of Interdisciplinary Research: Phases, Origins, and Key Turning Points (1981-2020). *ArXiv Preprint ArXiv:2501.05001*.

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, *24*(1), 92–96.

Sawyer, R. K., & Henriksen, D. (2024). *Explaining creativity: The science of human innovation*. Oxford university press.

Senge, P. M., & others. (1990). *The art and practice of the learning organization* (Vol. 1). New York: Doubleday.

Steiner-Khamsi, G. (2004). *The global politics of educational borrowing and lending*. Teachers College Press.

Visser, W. (2010). Schön: Design as a reflective practice. *Collection*, *2*, 21–25.

Xie, Z., Tang, X., & Jin, F. (2021). The International Engagement of Engineering Education in China: A Historical Case Study of Tsinghua University. *2021 ASEE Virtual Annual Conference Content Access*.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, *41*(2), 64–70.

张江波. (2017). *儒家仁学思想及其当代价值研究*. 兰州大学.

李砚祖. (2021). 设计史论研究与当代设计. 工业工程设计, *3*(04), 1-4+11. https://doi.org/10.19798/j.cnki.2096-6946.2021.04.001

赵汀阳. (2019). 跨文化聚点研究:文化边界,新百科全书与综合文本. 中央社会主义学院学报, *05*, 131–141.

BIOGRAPHICAL INFORMATION

Yufan Zheng is a doctoral researcher in Canterbury Christ Church University. Her research focuses on pedagogical innovation in higher design education for Generation Z learners, with particular interest in interdisciplinary curriculum design, creativity cultivation, and the localization of international educational frameworks within the Chinese context.

Anne Nortcliffe, Dean of the Faculty of Arts, Computing, and Engineering at Wrexham University, is a Professor of Inclusive Engineering and Technology with over 30 years of experience in Engineering, Technology and Design education, pedagogical practice development and research. Previously, she was the Founding Head of Engineering at Canterbury Christ Church University, establishing an inclusive engineering program. An advocate for diversity in engineering, Anne is an internationally published researcher and educator.

Hany Hassanin is a Professor of Digital Manufacturing and Engineering Research Lead (UoA12‑Engineering) in the School of Engineering, Technology and Design, supporting engineering research strategy and REF2029 impact development. His research focuses on additive and digital manufacturing and advanced materials, with applications spanning healthcare, sustainable materials and aerospace, and a strong track record in translation through prototypes and demonstrators. He has published 120+ papers, holds two patents, and has collaborated with UKRI, ESA, DSTL, Innovate UK, the Royal Society and industrial collaborators.

Stuart Lambert is Course Director for Product Design Engineering and holds a BA (hons) Industrial Design, an MBA and PhD candidate researching design skills at the interface of design and engineering and a Fellow of the HEA. He has worked in product design consultancy in London and Milan with 25 years of design, managerial and director experience and currently 6 years in academia

CORRESPONDING AUTHOR

Yufan Zheng
y.zheng34@canterbury.ac.uk