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PROMOTING INCLUSIVE LEARNING FOR CROSS-CULTURAL DESIGN COLLABORATIONS

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ABSTRACT
The imperative of creating inclusive learning environments remains a central focus in education, particularly within cross-cultural collaborations. While there is a broad consensus on its importance, approaches to achieving this goal vary across disciplines and contexts. This paper adopts a mixed-methods approach, including metacognitive surveys, field observations, and interviews, to explore the factors that contribute to fostering inclusive learning experiences in cross-cultural design collaborations among students from diverse backgrounds. Our research centres on international design workshops with students from universities in the USA and Taiwan, where participants collaborated to create product-service systems that emphasise sustainability, cultural inspiration, and target markets. Insights from these workshops reveal that, while cultural and language differences present significant challenges, these barriers can be mitigated through carefully structured instruction, clear communication of expectations, and the use of artifacts to aid design development. Moreover, design methods incorporating non-verbal and asynchronous communication strategies, such as the nominal group technique, effectively promote inclusivity, particularly for non-native speakers. The selection of topics and settings that encourage knowledge sharing and experiential exchange between students from different cultures further enhances the relevance, accessibility, and meaningfulness of the design and learning experiences. Although these findings are drawn from international design collaborations, we contend that similar strategies can benefit design education beyond the context of international workshops. We advocate for the broader application of these approaches and principles to foster inclusive and equitable learning environments across various design education settings and to create product-service systems that meet diverse cultural needs.

Keywords: Inclusive learning, cross-cultural collaboration, design education, metacognition

1 INTRODUCTION
In response to learners' diverse needs and challenges, the UNESCO Education 2030 report envisions education as a fundamental right, ensuring sufficient quality to foster relevant, equitable, and effective learning for all [1]. The pursuit of more equitable educational opportunities has driven research across various fields, including design education. This has led to the development of inclusive pedagogical approaches, such as Hockings' inclusive learning and teaching framework [2] and Universal Design for Learning (UDL) [3]. Additionally, policy support, teacher training, and resource allocation have been identified as key factors contributing to the success of inclusive educational practices [4]. Despite advocacy efforts and established frameworks, the implementation of inclusive and responsive learning environments remains highly context-dependent, necessitating empirical examination. While UDL emphasises providing multiple means of interaction as a strategy for inclusive learning, this approach alone does not fully address the complexities of non-traditional educational settings, such as design workshops. In these settings, learners often come from heterogeneous backgrounds and possess varying levels of prior knowledge. Ensuring equal access to knowledge and expression is only one aspect of meeting the diverse needs of learners.
Research has highlighted strong interconnections between diversity, equity, and inclusion (DEI) and design education, positioning it as an emerging field that requires interdisciplinary collaboration and cross-cultural understanding [5]. As a result, DEI has become integral to design education. Despite the promising strategies and frameworks proposed, the practical methods and approaches for implementing inclusive design education require further validation. This study aims to explore the methods and factors that contribute to fostering an inclusive learning environment in cross-cultural design collaborations.

Using a case study of design workshops between the U.S. and Taiwan, this research offers insights into effective strategies for inclusive design education. By providing recommendations on strategy and methods, this study contributes to advancing inclusive learning in cross-cultural design contexts.

2 INCLUSIVE LEARNING IN CROSS-CULTURAL DESIGN EDUCATION

2.1 What is inclusive learning and why is it needed in design education

Scholars and policymakers have long emphasised the importance of developing pedagogical approaches that value, respect, and effectively serve a diverse range of learners. A learner-centric approach prioritises meaningful, relevant, and accessible pedagogy and evaluation methods that accommodate students with different abilities [6]. In practice, inclusive pedagogy often takes one of two approaches: fostering a universal learning environment that emphasises commonalities among learners or addressing the specific needs of individuals through differentiation [7]. Universal Design for Learning (UDL) exemplifies the former, promoting inclusivity by providing multiple means of representation, expression, and engagement [3]. Conversely, inclusive pedagogy often tailored to specific subgroups or individuals focuses on supporting a wide range of human diversity including disability and special needs [7].

Despite broad recognition of its importance, the tools and techniques for implementing inclusive pedagogy vary widely across disciplines and educational settings. In project-based design studios, which is a common pedagogical model in design education, students often need to collaboratively establish the project's objectives and goals. This highlights the need to investigate inclusive learning in design education beyond a purely needs-based agenda. In cross-cultural design collaborations, cultural differences are often amplified in the co-creation process, as design decisions inherently reflect personal values and backgrounds. This dynamic necessitates that design educators remain attuned to power imbalances, equity in expression, potential biases, and cultural perspectives when facilitating ideation and critique during design development.

2.2 Completing the teaching and learning loop in design education

Numerous educational theories and models propose methods for assessing teaching and learning effectiveness through evaluation and reflection (e.g., ethnomethodology and conversation analysis frameworks [8]). In design education, assessment, which is often in the form of design critique, plays a pivotal role in shaping students' learning experiences. The Schön Reflective Model (SRM) centers on the act of judgment during and after the design process [9]. Design critiques facilitate a dialogue between instructors and students, enabling instructors to assess performance and provide feedback, while guiding students in developing critical judgment. Thus, design critique is a core competency in design education [8], and an essential pedagogical element to closing the teaching-learning loop [10].

Building on the SRM framework, this study employed a combination of assessment and reflection methods to gain insights into students' learning experiences, with a particular focus on factors contributing to their sense of inclusivity. These included small group critiques, presentation critiques, interviews, learning experience surveys, self-reflection reports, and the Metacognition Questionnaire (MCQ). Metacognition is the appraisal of the content of thought or cognitive processes [11]. The MCQ measures key aspects of metacognitive beliefs, judgments, and monitoring tendencies [12]. In this study, the MCQ was administered immediately following the ideation process to prompt students to reflect on their thought processes, establishing a connection between their activities and learning outcomes.

2.3 Research questions for cross-cultural design collaborations

Several studies have documented the challenges and potential solutions for cross-cultural learning environments. Common obstacles include language barriers, cultural misunderstandings, and differing learning styles, which can be mitigated through visual communication methods such as images and prototypes [13]. Additionally, clear communication, well-defined role allocation, and effective conflict management have been identified as key factors in facilitating successful cross-cultural collaborations [14]. This study focuses on examining methods related to the design development process, particularly during the ideation phase. Brainstorming is a widely adopted idea-generation method in design, aimed at opening up a broad spectrum of ideas by building on ideas of others [15]. The process is spontaneous, following guidelines such as “go for quantity” and “defer judgment,” and often includes timed sessions featuring quiet ideation and voting. In contrast, the Nominal Group Technique (NGT) is a structured method designed to build consensus by ensuring equitable participation in idea generation, discussion, and ranking [16]. Unlike brainstorming, which emphasises spontaneous idea generation, NGT provides

a more inclusive environment by systematically encouraging minority perspectives. Participants are asked to write down their ideas individually, take turns sharing them, and discuss one item at a time, ensuring that all voices are heard [17]. To explore inclusive learning in cross-cultural design education, this study was guided by two key questions:

- **RQ1:** What are the factors and challenges involved in fostering an inclusive learning experience in cross-cultural design collaborations?
- **RQ2:** What are the methods and tools that can promote an inclusive learning experience in cross-cultural design collaborations?

3 CASE STUDY: SUSTAINABLE INNOVATION DESIGN WORKSHOP

3.1 Research design

This study employed a mixed-methods approach, incorporating surveys, interviews, and reports. Online questionnaires were used to gather participants' (a) expectations and perceptions of inclusive learning and (b) metacognitive responses to two design ideation methods. The latter used the Metacognitions Questionnaire 30 (MCQ-30) to assess individuals' psychological processes related to the control, modification, and interpretation of thinking [12]. Additionally, semi-structured, in-person interviews were conducted to gain deeper insights into participants' learning experiences, particularly regarding challenges, equal learning opportunities, and the effectiveness of different design ideation methods. Self-reported reflection reports were also collected to further capture participants' perspectives.

To examine the impact of different ideation methods on learning experiences, the study introduced two ideation approaches: (a) brainstorming and (b) NGT. The 45-minute brainstorming session consisted of four stages: silent ideation (10 mins), brainstorming (15 mins), sorting and discussion (10 mins), and voting and refinement (10 mins). The NGT began with a 20-minute ideation phase, structured into three round-robin style sessions where participants silently responded to the following prompts: What are your ideas? Why might they fail? How might you refine them? After ideation, each group member took turns presenting one idea aloud (10 minutes total), followed by a 15-minute group discussion and voting.

3.2 Case study

In 2024, the research team conducted two design workshops over a three-week period in Taiwan centred on the theme "Innovations Through Sustainability, Technology, and Craft," with all activities facilitated in English. The participants were 17 students from a U.S. university (Workshops 1 & 2), 9 students from a university in northern Taiwan (Workshop 1), and 12 students from a university in southern Taiwan (Workshop 2). Except for four U.S. students, all participants majored in different design disciplines. Participants ranged in age from 17 to 28 and included 14 females and 11 males, representing nationalities including U.S., Taiwan, Vietnam, Malaysia, and Thailand. In both workshops, students were grouped into teams of 4–5 members, with each team comprising 2–3 students from the U.S. and 2 students from Taiwan. They collaboratively design product-service systems focused on sustainability, drawing inspiration from Taiwanese culture while targeting the U.S. market. Figure 1 illustrates an NGT session.

Figure 1. Idea generating session using Nominal Group Technique (NGT)

4 DATA ANALYSIS AND FINDINGS

Throughout the workshops, data collection included 4 learning experience surveys, 2 brainstorming sessions, 2 NGT sessions, 4 MCQ surveys, self-reflection reports (US=17), and interviews (US = 4, TS = 9). The interviews were voice-recorded, transcribed, and analysed using qualitative content analysis and code frequency analysis. Also, statistical methods were applied to interpret the data, providing insights that informed the study's conclusions.

4.1 Metacognition survey: brainstorming vs. NGT

The MCQ measures five dimensions: (a) Positive beliefs about worry, (b) Negative beliefs about uncontrollability and danger, (c) Cognitive self-consciousness, (d) Negative beliefs about the consequences of not controlling thoughts, and (e) Cognitive self-confidence. Responses were recorded on a four-point Likert scale, ranging from 1 (do not agree) to 4 (agree very much) [12]. For this analysis, we combined data from both workshops (n = 20) and conducted a paired t-test in R to compare the effects of brainstorming vs. NGT on metacognitive dimensions (Table 1). Results showed a significant decrease in "(Lack of) cognitive confidence" (p = 0.0306), indicating that the NGT approach significantly improved students' cognitive confidence.

Metacognitive dimensions	t-values	df	p-values	Difference in Means (NGT - Brainstorming)	95% Confidence Interval	significance
a. Positive worry beliefs	-0.129	19	0.899	-0.075	(-1.29, 1.14)	not significant
b. Uncontrollability and danger	0.206	19	0.839	0.1	(-0.917, 1.117)	Not significant
c. (Lack of) cognitive confidence	-2.34	19	**0.0306**	**-0.975**	(-1.849, -0.101)	**Significant**
d. Need for control	0.73	19	0.474	0.3	(-0.56, 1.16)	Not significant
e. Cognitive self-consciousness	0.101	19	0.921	0.05	(-0.985, 1.085)	Not significant

Table 1. The effects of Brainstorming vs. NGT methods on metacognitive dimensions

We used ANOVA to examine whether cultural background (U.S. vs. Taiwan) had a significant effect on metacognition scores (Figure 2). Results indicated that culture had a significant effect on all metacognitive dimensions (p = 0.00032), suggesting systematic differences between U.S. and Taiwanese students in how they controlled and interpreted their thinking during ideation. In general, U.S. students were less worried, felt more confident and in control, and were more self-conscious than students from Taiwan. The interaction between culture and ideation method was not significant (p = 0.795), indicating that both methods had similar metacognitive effects across cultural groups.

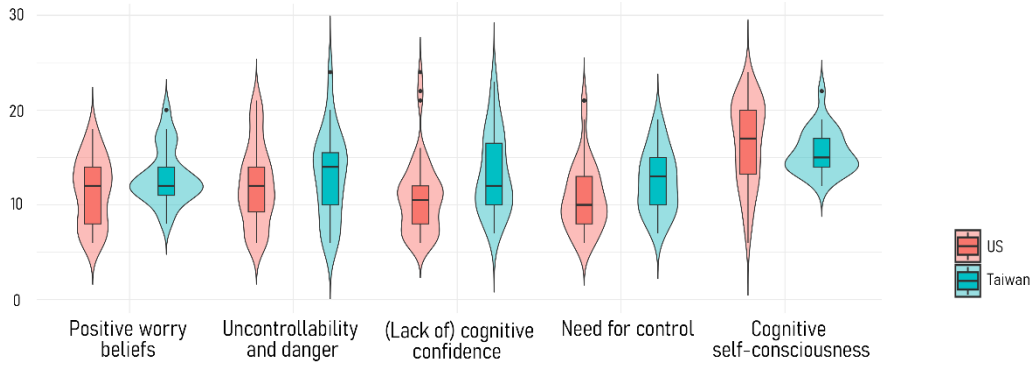

Figure 2. The U.S. vs. Taiwan students' rating on metacognitive dimensions

4.2 Learning experiences

4.2.1 Quality interaction

The survey results indicate that both groups identified "Time constraints," "Language," and "Collaborating with people of different backgrounds" as the most challenging aspects of the workshops. At the same time, "Interacting with students from different nationalities" was ranked as the most beneficial activity, followed by "Making and learning crafts" in both pre- and post-surveys (Figure 3). These findings align with the thematic analysis, which highlights interaction as both the most challenging and most valuable experience. Through collaboration, students became more aware of differences in thinking styles and design habits. In particular, quality interaction, including teamwork, discussion, and communication, emerged as the most critical element of learning. A U.S. student reflected: "I feel like I have an equal learning opportunity because both [the workshop director] and the professor from Taiwan value our perspectives and thoughts. We have a chance to share our own ideas." Additionally, both groups recognised the importance of reflection in their learning experiences. A

Taiwanese student described how working with U.S. teammates changed her perspective during a reflection session: “I realised my thinking process is pretty structured, and they inspired me to think more freely and boundlessly.”

4.2.2 Factors for inclusive learning

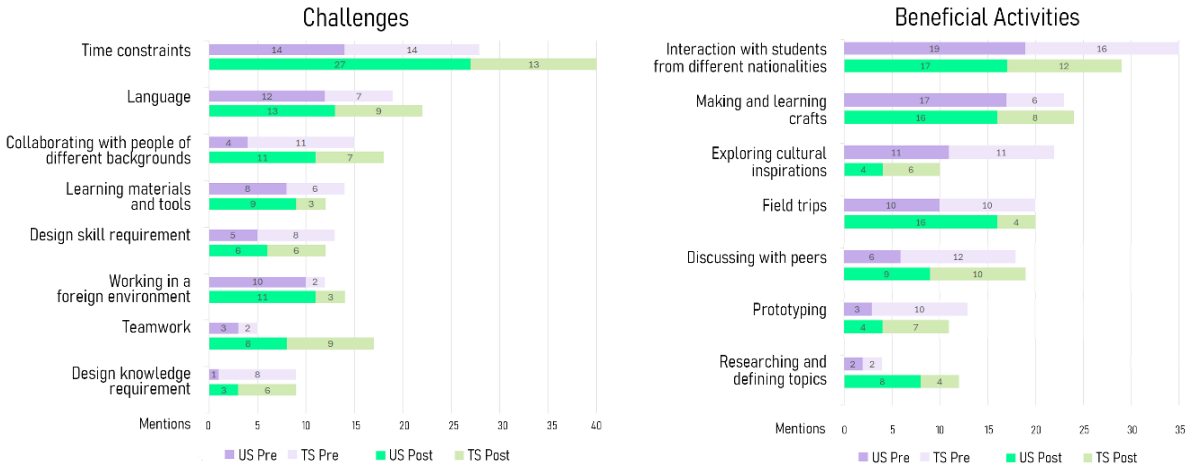

Figure 3. The most challenging and beneficial factors in the workshops

When asked, “I have equal opportunities to learn with and from other students,” both groups of students responded positively (US = 4.56, TS = 4.47 on a 5-point Likert scale: 5 = strongly agree). In terms of factors contributing to positive learning, U.S. students emphasised the value of feedback and learning through peer and instructor interactions. Taiwanese students highlighted the importance of learning tools, methods, and materials in facilitating equal learning opportunities. When asked about what contributes to inclusive learning, U.S. students cited diverse perspectives and the right to free expression. They also expressed a preference for brainstorming over NGT, as it allowed for more autonomous expression and with multiple discussion opportunities. In contrast, students from Taiwan valued structured frameworks, clear goals and prompts for concept development and critiques, and a more organised approach to discussion and evaluation. They preferred the NGT for its clear structure and effective time management, which ensured that everyone had an equal opportunity to share their ideas. Some students also mentioned that peer critiques using sticky notes, compared to presentations where feedback comes solely from instructors, was a refreshing change they would like to implement in the future. Both groups preferred developing and sharing concepts on paper rather than using online platforms like Figma or Miro, as paper allowed for easier sketching, capturing inspirations, and sharing ideas with peers.

5 DISCUSSION AND CONCLUSION

5.1 Beyond Universal Design for Learning

Our study demonstrates that quality interaction is most instrumental in creating inclusive learning experiences in design education. This suggests that merely following UDL principles, such as providing multiple means of representation, expression, and engagement, is insufficient to ensure quality and effective learning for diverse learners. Different user groups face unique challenges and exhibit distinct thinking and learning patterns, as evidenced by the systematic differences in metacognitive dimensions across cultural groups. While time constraints and language barriers were ranked as significant challenges in our study, teamworking and design knowledge requirement are more challenging for students from Taiwan. Conversely, U.S. students identified working in a foreign environment as a major challenge. These findings suggest that varying types of support are necessary for different learners. However, limitations in sample size and the scope of collected data constrain the comparability and transferability of our findings. Further evidence is needed to better understand the magnitude and causal relationship between designing educational activities and learning experience across diverse cultural groups and settings. Based on our research, we offer the following recommendations to promote inclusive learning in cross-cultural design contexts:

- Proper planning and time management for each activity, clear and transparent guidance, and the use of accessible communication methods (e.g., hand sketches and sticky notes) can enhance inclusiveness in design activities across cultural groups.
- Critiques from peers and instructors, along with reflection activities, are crucial for design development and completing the teaching-learning loop in design education.
- Structured learning activities, asynchronous interactions, and non-verbal communications are particularly beneficial for non-native speakers.
- Learning materials and methods are essential for facilitating effective interaction and ensuring equal learning opportunities, especially for students accustomed to more structured learning styles.

Offering multiple modes of learning is only the first step toward achieving equitable learning. Design activities are uniquely positioned to address these challenges, as they leverage creativity, visual expression, and prototyping to communicate ideas. With thoughtful planning of the design process, methods, and tools, many barriers to equity can be reduced. To promote inclusive learning in cross-cultural design collaborations, strategies and teaching materials should emphasise quality interaction, support asynchronous and non-verbal communication, ensure equal opportunities for expression and access to information, and incorporate reflection and feedback throughout the learning experience.

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