

UNCOVERING NEUTRALITY: A CRITICAL PEDAGOGICAL ANALYSIS OF BIAS IN DESIGN THINKING FRAMEWORKS

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ABSTRACT

Modern engineering and product design education uses design thinking frameworks like the Double Diamond and Human-Centred Design (HCD) as the most common teaching methods. These frameworks seem unbiased, universal, and transportable for student approaches to consumers, difficulties, and innovation. These frameworks are classroom-based. They are utilised worldwide in education. Design thinking is being applied to tackle more socio-technical problems in India, including urban informality, public health, sustainability, and social innovation. However, these frameworks' impartiality hides its cultural, social, and epistemological biases. This research uses critical design pedagogy to examine how mainstream design thinking frameworks affect Indian design students' understanding of users and design problems. The study examines student design challenge understanding. A qualitative comparative case study of three Indian design institutions with 126 students examines students' curriculum materials, studio critiques, and reflective diaries. Educational tools like empathy maps, personas, and stakeholder matrices adopt a normative "universal user" paradigm. A middle-class, metropolitan, able-bodied, Western paradigm is assumed. Thus, these mechanisms restrict culturally appropriate and inclusive innovation. This study proposes a culturally appropriate design pedagogy paradigm that blends reflexivity, situational ethics, co-creation, and design processes. This research seeks a solution. The research found that design thinking's neutrality must be questioned to properly teach engineers and designers to handle a variety of social situations. This is because design thinking is considered neutral.

Keywords: Critical design pedagogy, design thinking, Double Diamond, human-centred design, inclusive education, decolonial design, India

1 INTRODUCTION

In recent years, design thinking has become a more important teaching tool in engineering and product design education worldwide. The visual clarity, process orientation, and focus on empathy and creativity of frameworks like the Double Diamond and Human-Centered Design (HCD) have made them popular. Technical and commercial design colleges in India have seen these frameworks growing in popularity. They are often promoted as solutions to "wicked problems" in urbanisation, healthcare, sustainability, and social innovation. Despite their widespread dissemination, design thinking frameworks are typically advertised as useless and irrelevant in many contexts [1]. When applied to informality, structural inequality, caste systems, gendered work, and economic precarity, this premise is problematic. These variables characterise many Indian societal situations. This makes the assumption difficult. Teaching methods that simplify complicated realities into user personas or linear issue statements may ignore important parts of lived experience.

This main objectives of this study are:

To examine micro-level instructional methods used to operationalise bias in studio practice.

To focus on micro-level design tools, even if design thinking frameworks like the Double Diamond and HCD guide the higher-level design process.

2 LITERATURE REVIEW

Over the past two decades, design thinking has dominated engineering and product design education [1, 2]. This fosters creativity, innovation, and user-centred problem-solving. Most recommend it to enhance these skills. Double Diamond and Human-Centered Design (HCD) frameworks have had a large

influence because they are structured but adaptable, feature a clear visual depiction of the design process, and promote empathy-driven, iterative development [3][4]. HCD uses empathy, ideation, prototyping, and testing to understand user needs [5]. Design alternates divergence and convergence in the Double Diamond model [6]. Its use in university courses represents a change from technical training to multidisciplinary, process-oriented methodologies that promote iterative discovery, teamwork, and experience learning [7][8]. Design toolkits, curricular modules, and transdisciplinary innovation institutionalise these frameworks. Design schools, engineering, management, and policy schools use it [6]. Indian public technical institutes and commercial design schools use design thinking to solve "wicked problems" such as urban informality, healthcare access, sustainability, and social innovation. Design thinking solves these issues methodically. Design thinking is adaptable and can solve large socio-technical issues.

Many experts doubt design thinking concepts are neutral, universal, and culturally transportable. Perhaps these concepts are becoming more prevalent in education. Critics contend these frameworks assume epistemology and culture [9] [10]. Scalable, market-oriented solutions are assumed [11]. Also assumed are linear issue framing and individualist agency [12]. These assumptions are linked to Western modernist and management epistemologies that emphasise abstraction, efficiency, and optimisation. Personas, empathy maps, and stakeholder matrices use simplified user representations to aid learning, according to a study [12]. Divided into simpler groupings helps depict complex social realities [13] [14]. This abstraction may marginalise informal, precarious, and communal social connections. In India, where caste hierarchy, gendered employment, language variety, and informal government institutions affect daily life, universal design thinking may hide key parts of the lived experience [15] [16].

Critical design studies emphasise more that design processes provide knowledge, authority, and representation. Study focuses on this. Design thinking may increase instructional power [17]. A framework for issue definition and legitimising affected voices does this. Personas and empathy exercises may make designers interpret user experience instead of co-learners, creating unbalanced designer-community relationships [18]. Assessment standards, critiquing cultures, and institutional expectations that prioritise practicality, scalability, and formal innovation over social justice and ethical reflexivity amplify these dynamics in educational studios [19] [20]. Students may internalise normative beliefs about "good design" that coincide with dominant socio-economic norms, restricting their ability to critically reflect on marginalised contexts [21].

Critical design pedagogy challenges society's view of design education. This method emphasises power, positionality, and ethics in design learning environments using Freirean critical pedagogy, feminist epistemologies, and decolonial theory [22] [23] [24]. Critical design pedagogy questions how instructional techniques generate certain knowledge while ignoring others [2]. According to scholars, critical pedagogy helps students acknowledge their privilege, interact responsibly with communities, and question prevailing narratives of innovation and progress [25] [26]. This paradigm supports multiple epistemologies and culturally situated design practises that challenge universalist assumptions in non-Western countries like India [27]. Critical design pedagogy makes engineering and design education more inclusive, reflexive, and socially relevant by redefining design education as ethical and political [20].

3 DESIGN THINKING AND CRITICAL DESIGN PEDAGOGY

The Double Diamond model structures design into divergent and convergent phases, while HCD emphasises empathy, ideation, and prototyping. These frameworks have been adopted globally through standardised toolkits and curricular models (Figure 1).

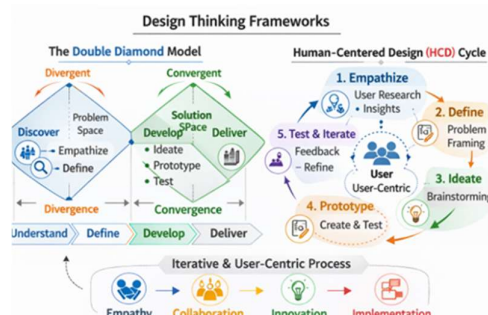


Figure 1. A synthesised model of the Double Diamond process and Human-Centred Design (HCD) principles. Source: Author

The thesis that is put up by critical academics is that design thinking provides precedence to individualist agency, market-oriented innovation, and simplified representations of users via the application of design thinking. On the other hand, the fact that such assumptions are made is a reflection of Western epistemologies, which put a focus on abstraction, efficiency, and scalability. The Indian context, which is characterised by design difficulties that are deeply based in social interactions, informal government, and collective activities, often reveals that these assumptions are inadequate when applied to the setting of India. Critical design pedagogy draws from a variety of sources in order to study power relations within the field of design education like decolonial research, feminist theory, and critical design pedagogy. In contrast to the traditional view of design methods as neutral tools, this approach analyses the ways in which pedagogies develop knowledge, authority, and representation inside the studio. It recasts design education as a process that is both ethical and political in character, rather than only concentrating on the technical elements of design.

4 METHODOLOGIES

This research uses a qualitative-dominant mixed-methods comparative case study strategy. This design relies on qualitative data, while quantitative content analysis uncovers patterns rather than performing statistical analysis. The research was done in a public technical university in North India, a private interdisciplinary design institute in South India, and a private design university in Western India. These institutions are all in India.

Nine academic members and 126 undergraduates from product design, interaction design, and engineering design studios participated in this project. To make interpretation clear, student work was interpreted across three studio project categories. Social innovation, including public health and sanitation, urban service design, mobility, and informal settlements, and consumer product design, including home products, were considered. Since the project context may affect user representation, classifying this information is crucial. If this possibility is ignored, bias may be misinterpreted.

4.1 Participant and Institutional Breakdown

The study was conducted across three Indian design institutions representing diverse academic and regional contexts:

- (1) a public technical university in North India,
- (2) a private interdisciplinary design institute in South India, and
- (3) a private design university in Western India.

A total of 126 undergraduate students and 9 faculty members participated in the study. The student sample was distributed across the three institutions to ensure comparative representation of different pedagogical environments (Table 1).

Table 1. Participants distribution

Institution	Type	Region	Students (n)	Faculty (n)	Program Context
Institution A	Public Technical University	North India	42	3	Engineering design + product design studios
Institution B	Private Interdisciplinary Design Institute	South India	40	3	Interaction design + interdisciplinary studios
Institution C					
Total			126	9	

5 DATA ANALYSIS

The study used a two-stage analytical approach combining quantitative and qualitative methods. First, student outputs were coded for socio-economic indicators, language patterns, and occupations, using statistical tests such as chi-square, proportion tests, and ANOVA to identify trends. Second, qualitative analysis of studio discussions and reflections examined implicit assumptions and user representation.

Key themes included the “universal user,” empathy abstraction, and institutional bias. Methodological rigour was ensured through dual coding of 20% of the data, achieving an inter-coder reliability of 0.82. A content analysis of 126 students across three Indian design institutions reveals a significant over-representation of middle-class, urban attributes in user profiles (Figure 2). (Figure 3).

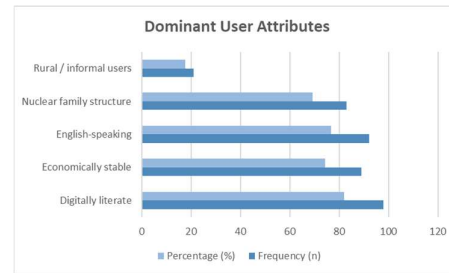


Figure 2. Dominant User Attributes in Student-Generated Design Personas. Source: Author

A chi-square goodness-of-fit test was applied to examine whether these attributes were evenly distributed across socio-economic categories.

$$\chi^2 (df = 4) = 46.72$$

$$p < 0.001$$

$$\text{Cramér's } V = 0.44 \text{ (large effect)}$$

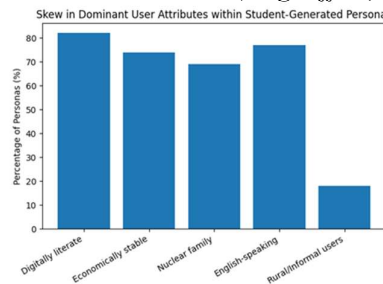


Figure 3. Skew in Dominant User Attributes within Students. Source: Author

Empathy maps (n = 90) were coded to distinguish between generic emotional abstractions and context-specific experiential descriptions (e.g., caste discrimination, migration stress) (Table 2).

Table 2. Nature of Empathy Representations in Design Studios

Empathy Representation Type	Frequency (n)	Percentage (%)
Generic emotional labels	67	74.4
Context-specific insights	23	25.6

Statistical Test and Effect Size

A one-sample proportion z-test was conducted against an expected proportion of 0.50.

$$z = 4.31$$

$$p < 0.001$$

$$\text{Effect size (Cohen's } h) = 0.51 \text{ (large)}$$

Empathy mapping overwhelmingly relied on abstracted emotional categories, significantly exceeding balanced representation. This reduction of perceived complexity into basic emotional categories turns empathy into a symbolic activity. Instead of fostering shared understanding, this strengthens the designer's power. Quantitative evidence supports criticisms of empathy as a depoliticised notion in design thinking courses.

The stakeholder matrices (n = 60) were analysed by using the mean priority ratings on a 5-point scale. The lowest priority was represented by a score of 1, and the highest priority was represented by a score of 5 (Table 3).

Table 3. Mean Stakeholder Priority Scores

Stakeholder Group	Mean	SD
Institutional actors	4.32	0.61
NGOs	3.78	0.74
Community members	2.41	0.83

Statistical Test and Effect Size

There was an analysis of variance performed using a single way.

$$F(2, 177) = 39.58$$

$$p < 0.001$$

$$\eta^2 (\text{eta squared}) = 0.31 (\text{large effect})$$

Tukey post-hoc: Institutional vs Community ($p < 0.001$)

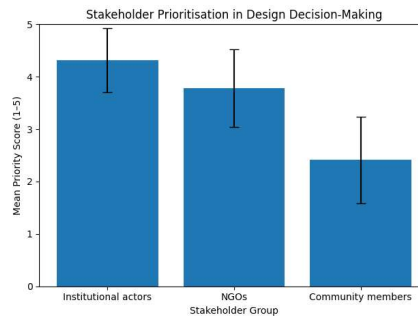


Figure 4. Stakeholder Prioritisation in Student Design Frameworks. Source: Author

It is important to note that the priority of stakeholders follows a particular hierarchical ordering, with institutional participants being valued more than members of the community to a higher extent. The enormous effect size indicates that the group of stakeholders has a large influence on design attention, which in turn pushes the outcomes toward feasibility and scalability rather than social justice or lived equality (Figure 4). This is because the design attention is influenced by the group of stakeholders.

6 FINDINGS

In accordance with the findings, students characterise users as "working professionals" and "digitally connected." The fact that this is the case suggests that the depiction of customers in design education is impacted by unconscious preconceptions that are linked with urban and middle-class origins. This is supported by the remarks made by members of the faculty, who advocate for a standardised "universal user." The technique of simplifying empathy mapping to generic emotional categories, while ignoring socio-cultural elements such as gendered work and caste, is a frequent practice. Students approach empathy as if it were a checklist, rather than participating in activities that have a significant impact on their behavior. Other biases are revealed via the investigation of stakeholders, such as the fact that institutions are given more weight than communities, that power dynamics are reflected, and that feasibility is given more weight than inclusive and participatory design.

7 DISCUSSIONS

The data imply that bias in design thinking teaching is mostly evident in personas, empathy maps, and stakeholder matrices. Since the results show that prejudice transcends these broad frames, this is true. These technologies turn design processes into operational procedures, enabling bias replication. Frameworks provide structure and turn design into operation. The study also shows that design education enhances efficiency, scalability, and homogeneity. This follows market-driven thinking but ignores social complexity and lived realities. This condenses socio-cultural realities into consumer-friendly images. Kimbell's critique of abstraction, Escobar's design methodology, and Costanza-Chock's design justice concept all align with these ideas. The research also shifts critique from framework to tool

analysis. This admits systemic and instructional prejudice. This is crucial in India, where caste, informality, and inequality require context-sensitive design solutions.

8 CONCLUSIONS

Design thinking promotes creative problem-solving, issue framing, and iterative learning in design and engineering education. When presented as a universal technique, it often hides social and cultural biases. Personas and empathy maps may promote urban middle-class views while marginalising others. Critical design pedagogy uncovers hidden assumptions by challenging representation, authority, and power in design processes. This method reframes design thinking as context-sensitive rather than discarding it. Critical, feminist, and decolonial perspectives improve design education understanding. This transformation is important in India because design interventions intersect with deep socioeconomic and geographical inequality. Critical design pedagogy may make engineering and design education more ethical, culturally relevant, and inclusive.

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