Participatory Design in Human-Computer Interaction: Cases, Characteristics, and Lessons

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Abstract

Participatory Design (PD) has become increasingly prevalent in Human-Computer Interaction (HCI) research. However, there remains a lack of comprehensive understanding of how PD has been used by HCI scholars. To bridge this gap, we sampled PD application cases ($N = 185$) from the SIGCHI conferences over the past decade and examined these cases through the dimensions of application features (e.g., contexts and functions of PD) and PD principles (e.g., its political commitment and mutual learning principle). Our analysis reveals the various ways PD has been applied in HCI and how its core features have been or have not been manifested in these cases. Based on these findings, we reflect on the conceptual understanding of PD within the HCI community and discuss potential misconceptions. Ultimately, we hope this work can serve as a useful reference for HCI researchers and beyond who are interested in incorporating PD into their design and research practices.

CCS Concepts

• **General and reference → Design**; • **Human-centered computing → Participatory design**.

Keywords

Participatory Design (PD), HCI Research, PD Applications, PD Features, Content Analysis

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1 Introduction

Participatory Design (PD) has been widely applied in Human-Computer Interaction (HCI) research nowadays. It is typically referred to as the design approach that actively involves relevant stakeholders (e.g., end-users, designers, developers, managers) in the co-design process to ensure that the result meets the needs and expectations of those who will be affected by it [29, 118, 165]. PD is grounded in the democratic belief that people who will be affected by design decisions should have a voice in shaping those decisions [118, 119, 147, 151]. This approach places particular emphasis on collaboration and co-creation between users and designers, often utilizing ethnographic methods (e.g., interviews and observations) and design tools (e.g., mockups and prototypes) to gather input from participants [29, 78, 94, 147].

Rooted in the political and social movements of the 1970s and 80s in Scandinavia, PD emerged as a response to the transformation of workplaces driven by the introduction of computers [63, 73]. PD was politically motivated to promote work well-being and democracy in the workplace, such as improving work quality, establishing democracy, and supporting user qualifications through new computer systems that incorporate user voices [63, 74]. Over time, PD has gained much attention from researchers and designers outside the Scandinavian and workplace contexts, which involved significant adaptations to fit different social, cultural, and political environments [78, 151]. These adaptations led to a more pragmatic and ethical approach, focusing on practical benefits and involving a broader range of stakeholders [73, 118, 147]. For instance, products, systems, and services with good usability and user experience can be developed through PD that lead to higher user acceptance and satisfaction [31, 93]. Additionally, the associated human activities can also be more effectively supported, such as improved work productivity and quality [63, 151]. Given these pragmatic benefits of PD, researchers and designers have applied PD in various fields, such as urban studies [53], public policy [37], and global health [35]. HCI scholars are no exception, increasingly adopting and practicing PD across diverse technological contexts and for a range of purposes [56, 109], including but not limited to areas such as designing healthcare systems [22], children's learning activities [88], and community building [135]. For example, Coenraad and colleagues [49] conducted PD sessions with a range of educational stakeholders—students, teachers, administrators, and parents—to develop culturally relevant Computer Science curricula for young learners aged 10-14. Similarly, Duarte and colleagues [57] engaged in PD activities with young forced migrants to understand their initial settlement process and reflected on the challenges and methodologies of conducting PD with vulnerable groups.

Given PD's wide application, many community groups and fields have systematically analyzed its use in their specific areas, such as health interventions [115, 170] and formal education [166]. However, we still lack a comprehensive understanding of how PD has been practiced and its utility in advancing HCI research. For example, what are the roles that PD serves in HCI research? How can PD activities be effectively designed and implemented for HCI

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work? Such knowledge gaps may impede the effective integration of PD in HCI research, particularly for those new to the approach. Additionally, PD is a concept open to various interpretations, with researchers from various backgrounds offering diverse perspectives on its characteristics, resulting in inconsistencies in how PD is understood by different scholars and practitioners [119, 151]. As Schuler and Namioka [147] put it, *"Participatory design is many things to many people"* (p. 27). This disparity may further lead to confusion and inaccuracies within HCI research on PD, manifesting as challenges in grasping the definitions, processes, and methodologies associated with PD. For example, some people have interpreted PD as *"user participation"* or *"user workshops"* [79], and we have observed instances where approaches that did not involve participants in design decisions but merely as testers were labeled as PD. In summary, given the existing misconceptions and misapplications of PD within the HCI community, it is essential to examine how HCI researchers have applied PD in their work to clarify its boundaries for the community, ultimately promoting more accurate use of the approach and facilitating its further development.

Aiming to bridge these gaps around the understanding and application of employing PD in HCI research, we systematically collected research articles that self-claimed conducting PD published in the SIGCHI conferences (N = 26, e.g., CHI, CSCW, DIS, IDC, etc.) in the past ten years (i.e., 2014-2024, N = 185). Our analysis is guided by the research question – ***how has participatory design been incorporated into HCI research over the past decade?*** Specifically, we examined the included cases through two perspectives: the application features of PD in HCI (such as the application areas and how PD functioned to serve research goals), and key features of PD practices (i.e., how different principles of PD, like political commitment and mutual learning, were manifested). Our findings reveal that PD in HCI research served three main purposes: as a research method to explore design spaces, as a design approach to develop new solutions, and as a research context to expand the conceptual framing and practice techniques of PD. We also offer insights into how different PD's key features were, or were not, demonstrated in HCI applications, such as the commitment to democracy and the enactment of design through reflection-in-action. Lastly, based on these findings, we reflect on how PD applications in HCI build on and extend current understandings of PD, and address some misconceptions about PD that exist within the community. Note that this work is not a systematic review of PD applications in HCI for two key reasons. First, HCI is an interdisciplinary field with blurred boundaries, making it challenging to decide which venues to include in the search. Second, PD has been extensively practiced both within and beyond HCI over the past half-century (e.g., a Google Scholar search for "participatory design" yields over 170,000 results as of August 2024), making it impractical to screen and analyze all relevant papers. Instead, our research focuses on understanding HCI researchers' PD practices, which can be effectively examined by sampling and analyzing representative HCI papers until data saturation is reached—similar to how interview studies do not require interviewing every eligible participant.

Overall, this work mainly makes three-fold contributions to design-related communities, such as technology design and design research, within HCI. First, our paper is the first in the HCI community to comprehensively examine and reveal how HCI scholars utilize PD in their research practices. The findings offer concrete examples that can serve as references for other HCI researchers interested in employing PD in their work. Second, we link these findings to the key features of PD described in the PD literature and deepen the conceptual understanding of PD in HCI. Third, we discuss potential misconceptions of PD in HCI, which can serve as a reference for other researchers and designers when framing PD in their projects.

2 Background: Participatory Design

This work aims to explore how HCI scholars have employed PD in their research practices. To provide sufficient background, we offer an introduction to the historical roots of PD, its development, as well as its framings and key features.

2.1 Historical Roots of PD

The term *"Participatory Design"* originated from the Scandinavian *"Cooperative Design"* movement of the 1970s and 1980s, specifically in Denmark, Norway, and Sweden, which emphasized collaboration between users and designers within the context of democratizing work environments [20, 31, 63]. This period marked the beginning of PD's practical and theoretical development, which has since become the foundation for international and contemporary PD research and practices. Specifically, the emergence of PD in Scandinavia was closely tied to the region's strong tradition of industrial democracy and union influence. In the early 1970s, new legislation in Scandinavian countries increased opportunities for worker influence, leading to the initiation of projects that aimed to enhance worker participation in the development and use of new technologies [26, 31]. These early projects, often referred to as the *"first generation"* of PD, focused on empowering workers through collaboration with unions and management primarily in the manufacturing industry [48], developing new work practices and creating criteria for better working environments [26]. By the early 1980s, a *"second generation"* of PD projects emerged, emphasizing the design of computer systems that supported user skills and product quality in office environments. These projects addressed issues of dehumanization in technology use and aimed to improve the quality of work and products. Notable examples include the UTOPIA project, which involved typographers in designing technology to enhance their skills and the quality of their work [31]. By the late 1980s, PD practices had expanded to service industries, where gender issues became more prominent due to the higher prevalence of women workers [20, 48, 63].

Several features characterized the early development of PD in Scandinavia. First, these early PD projects were often initiated by researchers in collaboration with trade unions, aiming to empower workers to co-determine the development of information systems and their workplaces [26, 31, 73]. However, the influence of labor unions, which were strong allies in democratizing participation in systems design during the 1970s and early 1980s, had since diminished [26]. Second, the unique cultural and social factors of the Scandinavian region contributed to the emergence of PD, including a lack of a long industrial tradition, a high capacity for negotiation, strong and cooperative trade unions, and a tradition of egalitarianism and democracy [20, 63]. Meanwhile, government and societal initiatives also played a significant role, with national, government-funded projects launched by trade unions and conducted in collaboration with researchers helping to establish new theoretical foundations, strategic models, and methodologies for PD [63]. In terms of theoretical framing, the early Scandinavian PD projects and movements were grounded in various perspectives, mainly including the Collective Resources Approach [26, 63, 165], the Socio-Technical Approach [13, 120], Action Research [26, 48, 151], and Marxism [31, 155]. These approaches were aimed at empowering labor, particularly in its struggle with management, in relation to the introduction of new technologies [154].

In short, PD's emergence in Scandinavia was driven by a combination of legislative changes, strong union influence, cultural factors, and government initiatives, all aimed at increasing worker influence and democratizing the design and use of new technologies. Influenced by progressive ideas in computer system development and strong union movements, the core values of the Scandinavian approach include full user participation, enhancing workplace skills, improving work quality, and viewing the design process as inherently political [78, 136].

2.2 PD Development

From the late 1980s to the early 2000s, PD saw significant development outside Scandinavia, particularly in North America. The first Participatory Design Conference (PDC '90) held in Seattle, Washington, in 1990, marked its widespread adoption globally [31, 78]. However, the development of PD outside Scandinavia has undergone significant transformations to adapt to unique social, cultural, and political environments [118], especially in the U.S., where the weaker position of unions and lower union membership compared to Scandinavia necessitated a shift in PD's focus from strong union support to other forms of worker empowerment [72, 147]. This adaptation involved tailoring PD to fit different legislative, workplace, and cultural contexts, emphasizing democratic values and process-oriented approaches rather than relying on union support [73, 147]. The U.S. adaptation of PD also emphasized practical benefits such as effective knowledge acquisition and product quality to gain acceptance in a corporate environment that prioritized efficiency and productivity [119, 147]. Additionally, the adapted approach involved a broader range of stakeholders, including developers, technical writers, trainers, marketers, and testers, to ensure that all affected parties had a voice in the design process [119, 147]. Despite these changes, the core political principles of PD—improving the quality of working lives and involving users in the collaborative development of technology—remain central to its practice during this period [73, 118, 147].

Contemporary PD, situated within the current wave of information system development that addresses people's needs in diverse daily life situations [157], has significantly expanded its application areas and design contexts beyond workplace computer systems. Specifically, with the rapidly evolving technological landscape of the 21st century, particularly since the 2010s, PD has been applied to the design of technologies, products, services, and policy across a wide range of domains, including public and private service sectors, manufacturing, local and centralized administration, hospitals, libraries, law offices, and schools [78, 93, 117, 151]. Just as Clement and Besselar noted, the fundamental principles of PD are effective in various settings [48]. However, some PD scholars have recently highlighted a tendency towards depoliticization in contemporary PD, which often focuses on pragmatic and ethical issues while neglecting its political goals of democracy and user empowerment [33, 107, 157], such as the emphasis on immediate, *"here-and-now"* issues while lacking long-term visions and technological ambitions [33]. Accordingly, there is a call in the PD literature to re-politicize PD by addressing *"big issues"* that matter and aiming for long-term technological impact [33, 107]. Inspired by the evolution of PD, this study aims to investigate and understand how HCI scholars currently interpret and practice PD. Our goal is to provide insights that reflect on the concept, thereby facilitating the effective incorporation of PD into HCI research.

2.3 PD Framings and Features

Despite its widespread application today, there is still no universally accepted definition of PD since its inception in Scandinavia during the 1970s [63]. Scholars and practitioners have differing views on PD: some insist on its political agenda while others value more the practical advantages of involving users in the design process [33, 107, 157]. As a result, we can find many different PD definitions in the literature, each focusing on different aspects of PD. For instance, Törpel and colleagues describe PD as *"the direct participation of those (working) lives will change as a consequence of the introduction of a computer application"* [165, p. 14]; Robertson and Simonsen, in the book *Routledge International Handbook of Participatory Design*, define it as *"a process of investigating, understanding, reflecting upon, establishing, developing, and supporting mutual learning between multiple participants in collective 'reflection-in-action'"* [151, p. 2]; Bødker and colleagues, instead, argue that PD *"is a concern for engaging human beings in the design of future technology… as a way by which people can influence digital technologies that will change their work practices or everyday life"* [29, p. 2-3]. Similar to these different framings, PD was often referred to by various names [41, 73, 137], especially in its early development stages from the 1990s to the early 2000s, such as *"Cooperative Design"* [147], *"Contextual Inquiry"* [91], *"Work-oriented Design"* [23], *"Participatory Evolutionary Development"* [101], and *"Cooperative Experimental System Development"* [75]. However, since the mid-2000s, these alternative terms have become less common in the literature, with researchers and practitioners increasingly adopting the term *"Participatory Design"* directly.

Although interpretations of PD may vary, there is a general consensus among PD researchers and practitioners that *"Participatory Design is not defined by formulas, rules, and strict definitions but by a commitment to core principles of participation in design"* [151, p. 3]. Our Table 4 in the appendix outlines major literature on PD over time, starting with one of the earliest systematic studies by Floyd and colleagues in 1989 [63], which explored PD's history, practices, and features in its Scandinavian origins, and extending to the latest guidebook by prominent PD scholar Susanne Bødker in 2022 [29]. It is evident that throughout PD's development history, its core principles have largely remained consistent since the term's introduction in the 1980s. To facilitate the analysis and interpretation of our work, we categorized the features covered in the Appendix into

Table 1: Key features of participatory design

Dimensions	Brief Explanation
Cooperation	Users (referring to people who are directly influenced by the design outcome; a required group), designers (broadly including design professionals, developers, or researchers; a required group), and other stakeholders (e.g., managers and policymakers; a recommended but optional group) jointly work together toward shared design goals [80, 118, 155, 157]
Political Commitment	Democracy: People who are affected by a decision (mainly the intended end-users) should have an opportunity to influence it [78, 151], especially participating in design decision-making [73, 93, 118, 147]
	Empowerment: The design aims to improve and support user participants' future use and practice [24, 29, 155]
Mutual Learning	Participants and designers learn from each other's expertise to better inform design directions and outcomes, such as designers' learning of users' present practices and users' learning of technological options [51, 93, 151, 156]
Creativity	Participants' and designers' collective reflection-in-action to envision new designs and simulate future scenarios, typically based on mutual learning results, present practices, and designing by doing [13, 32, 151, 157]

four dimensions: ***cooperation*** among participants (i.e., end-users, and often involving other stakeholders) and designers (broadly including design professionals, developers, and researchers); ***political commitment*** to democracy (i.e., shared power and decision-making between participants and designers) and empowerment (i.e., aiming to improve and support user-relevant practices) during and through design activities; ***mutual learning*** in the design process (i.e., knowledge exchange between participants and designers to guide better design outcomes); and ***creativity*** through reflection-in-action (i.e., collectively envisioning new designs based on user current practices and designing-by-doing). Table 1 provides a brief explanation of these features. We will use the four key dimensions as an analytical framework to examine how these PD features are, or are not, manifested in the PD practices of HCI scholars, demystifying HCI researchers' understanding of the approach. Given the limited space and the fact that thoroughly explaining these key features is beyond the scope of this paper, please refer to the literature listed in Appendix (Table 4) for detailed explanations.

3 Method

In this section, we present our processes of sampling PD cases in HCI, the authors' positionality, and how we analyzed the included cases.

3.1 Sampling PD Cases in HCI

To sample representative PD cases in HCI, we focused on the ACM SIGCHI conferences. SIGCHI stands for Specifical Interest Group on Computer-Human Interaction, which is *"the leading international community of students and professionals interested in research, education, and practical applications of Human-Computer Interaction"* [150]. SIGCHI sponsors/co-sponsors 26 HCI conferences, such as ACM CHI, CSCW, DIS, IDC, CHI Play, HRI, MobileHCI, UIST, and UbiComp/ISWC, see table 5 in the appendix for the full list. These conferences encompass all current HCI research topics and contexts, including but not limited to design and creativity, social computing, game and play, children and interaction, sustainable computing, interface design, and tangible computing. This comprehensive coverage provides a rich and thorough database to answer our research question. Additionally, we aim to understand *contemporary* HCI researchers' practices with PD, as this has more direct implications for the future use of PD features in HCI. Furthermore, Halskov and Hansen [78] have already reviewed PD research practices at the Participatory Design Conferences (PDC) from 2002 to 2012. We, therefore, sampled papers published in SIGCHI conferences over the past decade (i.e., around 2014 – 2024).

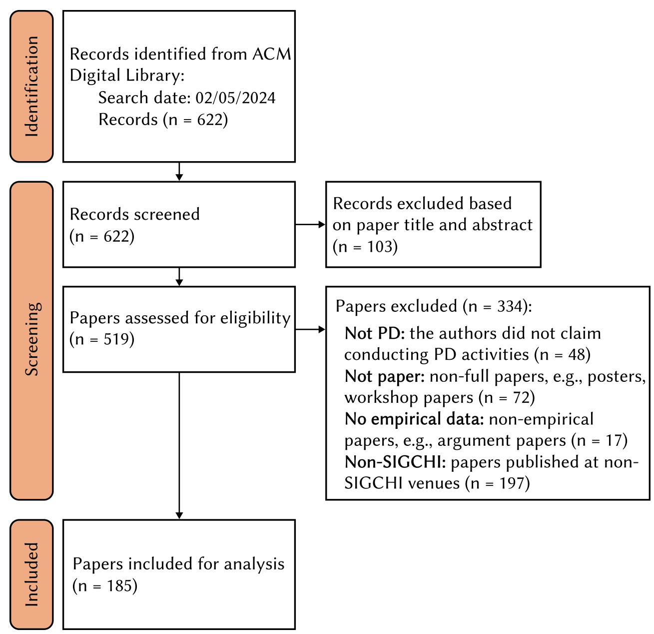

Figure 1: The paper search and screening processes

We followed the PRISMA protocol [126] to structure our processes for searching and reporting relevant PD papers (see Figure 1). Specifically, we searched for the exact term *"Participatory Design"* within paper abstracts in the ACM Digital Library on May 2, 2024, where all the SIGCHI conferences are archived. We limited the research results to research articles from publication dates between January 1, 2014 and the search day, resulting in 622 items. For these returned results, we first conducted a loose screening by reading the paper titles and abstracts to identify papers that involved PD, narrowing the results down to 519 papers. We then applied a stricter filtering process to these 519 papers by examining their full text, focusing on whether the authors explicitly claimed to have conducted PD activities, particularly in the introduction and methods

Table 2: The paper inclusion and exclusion criteria for sampling

Dimensions	Inclusion	Exclusion
Intervention	Claiming PD: The authors self-claimed they conducted PD	The authors did not claim conducting PD (e.g., simply saying conducting design workshops)
	Empirical: The paper provides an empirical account of the self-claimed PD process	Non-empirical papers, e.g., argument papers and literature reviews, or lacking empirical details
Presentation	Full papers	Posters, workshop papers, work-in-progress papers, etc.
	The paper was published at one of the 26 SIGCHI conferences	The paper was published at non-SIGCHI venues

sections (e.g., *"...we conducted six participatory design workshops with women..."* [145, p. 6]). Through this examination, we identified 185 papers that met the inclusion criteria outlined in Table 2. The full list of included papers is provided in the supplementary file.

3.2 Authors' Positionality on PD

Given the ambiguous nature of PD and its varying interpretations, it might be helpful to provide our positionalities to aid readers in understanding our analytical approach and the development of our arguments before introducing the data analysis details. The first author (A1) is a Ph.D. student in Design Research at a public research university in Asia, holding a bachelor's degree in Product Design and a master's degree focused on Service Design from the same region. Prior to this research, A1 had professional teaching experience in PD for college students majoring in Product Design. A2 is a university professor at the same institution, teaching undergraduate and graduate students majoring in Interaction Design, covering courses about PD as well as interaction design practices and theories. A2 holds a bachelor's and master's degree in Industrial Design from Asia and a Ph.D. in HCI from the United States. Both researchers have observed and experienced significant challenges design students face when learning PD, particularly in understanding its features and distinguishing it from other design methods such as User-Centered Design and Co-design. Therefore, we adopt a strict stance on scoping the boundary of PD by sticking to the key features listed in Table 1 for this work, especially the core principles of democratic empowerment. For example, we consider cases that merely involve users for feedback on prototypes through design workshops (violating the "creativity" and "political commitment" principles), or that exclude the intended users from the design process (violating the principle of "political commitment"), as misconceptions of PD. Otherwise, we are concerned that PD will eventually lose its identity by being conflated with other design approaches.

3.3 Analyzing the Sampled Cases

The analysis was guided by our research question of how PD has been incorporated into HCI research over the past decade. Specifically, we analyzed the following two aspects of the included papers: *application features of PD in HCI* (i.e., the application areas and the purposes of employing PD), *PD features* (i.e., the four key PD dimensions presented in Table 1 – cooperation, political commitment, mutual learning, and creativity).

Data Coding Process. We employed Content Analysis [98, 133] to examine the two aspects of each paper. The data analysis process primarily involved two researchers. As the first step, A1 reviewed all 185 papers and used the qualitative analysis software MAXQDA to tag relevant information based on our analytical focuses. The tagged data was then exported into Excel sheets for subsequent manual coding. For the dimension of PD features, A1 first extracted information based on application areas, coded the functions of PD in serving each paper's research goals, and clustered similar codes. A1 and A2 then collectively reviewed and categorized the initial codes through regular meetings, generating themes for application areas (e.g., *"Education & Learning," "Healthcare & Wellbeing,"* and *"Civic Challenges"*), topic attributes (e.g., *"Individual level"* and *"Humanity-orientation"*), and PD functions in HCI research (e.g., *"PD as a design approach to develop new solutions"* and *"PD as a research context"*).

The coding and synthesis of the second analytical aspect—PD features—were guided by the dimensions outlined in Table 1, including cooperation, political commitment, mutual learning, and creativity. Our focus was on how each of these four dimensions was or was not represented in all 185 papers. Table 3 provides the analytical directions (and prompts) for examining PD features under the four dimensions. For each dimension, we followed a bottom-up approach to inductively generate relevant themes. Specifically, A1 initially analyzed relevant information to generate preliminary codes, then discussed these with A2 to refine them—such as renaming, re-categorizing, and merging themes—until both researchers agreed that the developed themes clearly and accurately reflected the findings. Through this iterative process of coding, merging, and refining, we developed a comprehensive set of themes for the dimensions of cooperation (e.g., *"End-users"* and *"Other stakeholders"*), political commitment (e.g., *"Goal empowerment"* and *"Process empowerment"*), mutual learning (e.g., *"User present practice"* and *"Technology options"*), and creativity (e.g., *"Oral expression"* and *"Visual presentation"*).

To validate the effectiveness of the coding results by A1 and A2, a third external researcher with a design-training background independently coded a randomly selected sample of 10 papers. Specifically, the third researcher used the coding results from A1 and A2, namely the identified themes regarding *application features of PD in HCI* (application areas and purposes of using PD) and *PD features* (cooperation, political commitment, mutual learning, and creativity), to perform deductive coding on the 10 sampled papers. The coding results were then compared to the final coding results generated by A1 and A2 to assess inter-rater reliability, yielding a Cohen's Kappa score of .83 (*"Almost Perfect"* [102]), indicating

Table 3: The analytical directions for the four dimensions of PD features

Dimensions	Analytical Directions
Cooperation	Who was involved in the cooperative design process?
	What were their roles?
	How did they collaborate with each other in the design process?
Political Commitment	Democracy: How did user participants (if any) influence design decision-making?
	Empowerment: How were user participants (if any) supported in terms of design goals and processes?
Mutual Learning	What did participants learn from designers and how?
	What did designers learn from participants and how?
Creativity	Were any new design ideas generated, and from whom?
	How were the new design ideas generated?

the reliability of the collective analysis results from A1 and A2. Finally, A1 organized all the identified themes and synthesized relevant cases into findings, which were then reviewed, revised, and finalized by A2.

Examining Data Saturation and Findings' Generalizability. To determine whether our findings comprehensively reflect the application landscape of PD in HCI, we assessed data saturation and generalizability through a two-step process. First, we examined whether data saturation was achieved within the analyzed set of 185 papers. Following the order of papers listed in the supplementary file, we identified the point at which data saturation was reached in our analysis: no new themes for application features of PD emerged after the 34th paper, and no new themes for PD features emerged after the 68th paper. Therefore, our data has reached saturation with respect to the research goals of this paper.

Second, we evaluated whether our findings from SIGCHI conference publications could be generalized to studies in other HCI venues. We randomly sampled eight additional papers from four representative HCI journals: [69, 129] from *ACM Transactions on Computer-Human Interaction* (ACM), [68, 182] from the *International Journal of Human-Computer Studies* (Elsevier), [143, 172] from the *International Journal of Child-Computer Interaction* (Elsevier), and [65, 180] from *Human-Computer Interaction* (Taylor & Francis). A1 coded these papers and did not identify any new themes. Thus, we are confident in claiming that, although not exhaustive in including all qualified HCI papers, our findings comprehensively reflect the current landscape of incorporating PD into HCI research.

4 Findings

Figure 2 presents the publication features of the 185 papers included in the SIGCHI conferences in the past ten years. As shown in Figure 2(a), of the 185 papers, the majority were published at CHI (48.65%), followed by DIS (12.43%), and both CSCW and IDC (11.89% each). Papers published at other conferences each account for less than 10%. Regarding publication years (Figure 2(b)), the highest number of papers were published in both 2021 and 2023, each accounting for 14.05%. The years 2022 and 2019 each had 12.43% of the papers, 2020 had 11.89%, and 2017 had 9.19%. As to the regions, we identified a total of 33 countries/regions from the analyzed papers (Figure 2(c)). Most studies were conducted in the USA (45.41%), followed by the UK (13.51%) and Germany (7.03%). Papers from other countries/regions each account for less than 10%. A few papers introduced cross-cultural contexts, collecting data from multiple locations (6.49%), such as France, Greece, and Romania [162]. The following sections begin with an overview of how PD is applied in HCI (Section 4.1), followed by the findings on how the four dimensions of PD features were represented (Section 4.2).

4.1 Application Features of PD in HCI

For application features, we present the contexts in which the PD was applied, the functions of PD in serving the papers' research goals.

4.1.1 PD's Application Areas. Figure 3 provides an overview of the findings on the specific application areas of PD in HCI. Of the 185 papers, various PD application areas were identified. The most prominent area was *Healthcare & Well-being* (N = 63, 34.05%), such as designing assistive robots for elderly people [158]. *Education & Learning*, such as using PD to investigate challenges and opportunities in VR-based educational practices [86], was the second most common focus (N = 29, 15.68%), followed by *Communication & Social Media* (N = 25, 13.51%), e.g., employing PD to improve mixed-group video conference communication [96]. *Technology & Interaction* (N = 20, 10.81%), which focused on using PD to create new interfaces or interaction mechanisms like an origami-inspired foldable smartwatch [181], was another prominent area. Other application areas included *Civic Challenges* (N = 16, 8.65%), e.g., using PD to address racism and discrimination issues affecting transgender and non-binary people [77, 164]; *Transportation & Traveling* (N = 11, 5.95%), i.e., designing for transportation contexts, such as the development of external Human-Machine Interfaces for vehicles [8]; *Creativity Support* (N = 10, 5.41%), i.e., supporting people's creative activities, such as designing digital tools like mood boards to help designers better express and communicate their creative concepts [97]; *Privacy & Security* (N = 8, 4.32%), i.e., leveraging PD to enhance privacy and security in system design, for example, creating apps that provide safety services specifically for women [178]; and *Sustainable Development* (N = 3, 1.62%), i.e., using PD to

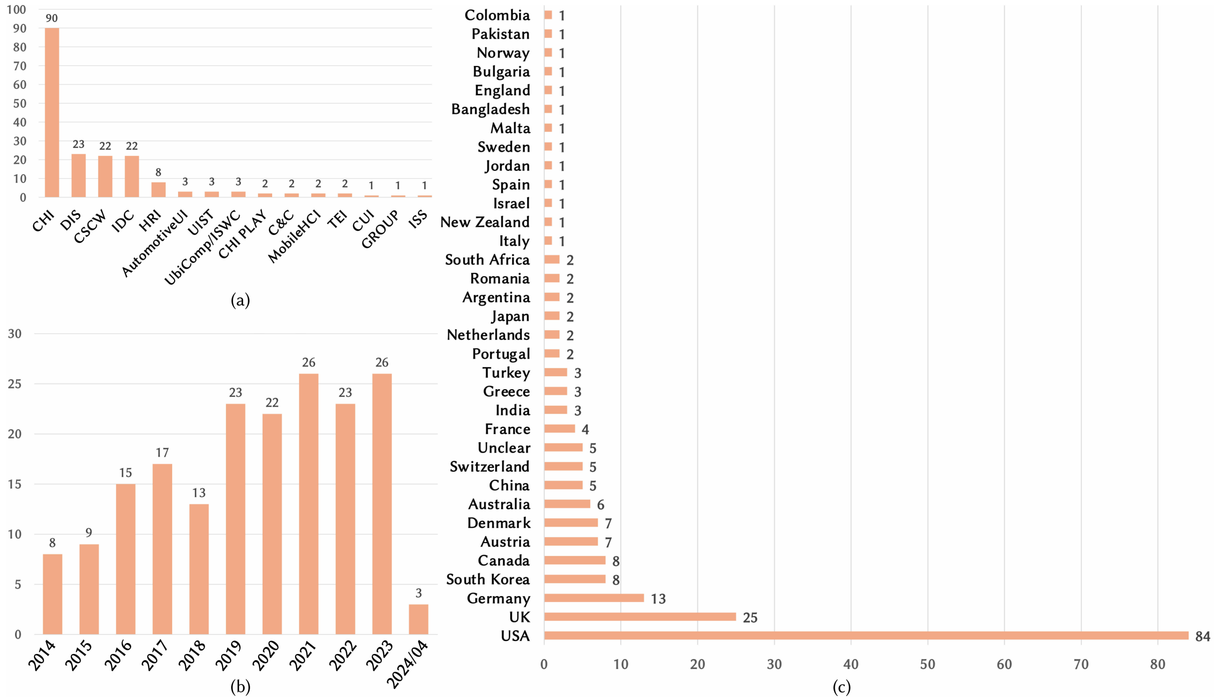

Figure 2: The publication venues, years, and countries/regions of the sampled PD papers

support sustainable development goals, such as using PD fiction to promote sustainable domestic energy consumption [134].

Across different application areas, 84.32% of papers (N = 156) specifically aimed to address human-centered matters through PD, such as empowering elderly people [83] and supporting refugees [62]. For example, PD had been used to identify qualities of technology that could support people in coping with racist interactions [164, 183]. The remaining 29 papers (15.68%) employed PD to explore technical-oriented topics, such as developing wearable devices

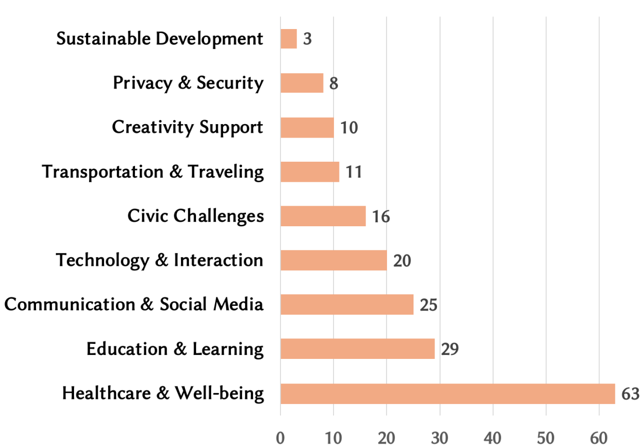

Figure 3: PD's different application areas in the examined papers and the number of papers

for games [87] and designing gesture-based interactions in vehicles [111].

4.1.2 The Functions of PD Practices in HCI Research. Among the 185 papers analyzed, we identified three primary functions of PD practices in HCI research, including leveraging PD as a research method to explore design space, as a design method to develop new solutions, and as a research context focusing on PD itself.

The majority of studies utilized **PD as a research method to explore design spaces** (N = 97, 52.43%). Specifically, some papers employed PD to *understand user experiences and perspectives* through a combination of ethnographic approaches (e.g., interviews and focus groups) and design activities (e.g., sketching and prototyping). For example, Oliver and colleagues [77] leveraged PD to explore the pressing challenges faced by transgender individuals mainly through stretching exercises. Some studies used PD to *explore and define design directions.* For instance, Tuli and colleagues [167] utilized PD to explore design directions for menstruation by engaging participants in identifying challenges and conceptualizing safe spaces for managing menstrual hygiene, with a focus on how technology can support menstrual mobilities in stigmatized cultural contexts. Additionally, some papers utilized PD to *develop design principles and guidelines.* An example of this is from Franceli et al. [46], who involved participants in identifying critical considerations for designing technological interventions for children with ADHD.

Secondly, 49 papers (26.49%) leveraged **PD as a design approach to develop new solutions**, mainly new computer systems, which can further be classified into two types. The first type focused on developing *new designs*, where participants were involved in the entire design process to generate design outputs from scratch, from understanding user needs to design ideation, prototyping, and evaluation (e.g., [84, 162]). Note that in some cases, participants primarily took part in ideation phases and mainly provided feedback on prototypes developed by researchers in later design stages (e.g., [17, 82]). The second type is *evolutionary prototyping*, where participants provided feedback and iterated on existing technologies or early prototypes created by designers, rather than designing from scratch (e.g., [15, 90]). This approach often extended into evaluation phases, such as user testing and field deployment (e.g., [17, 106]).

Finally, 39 papers leveraged **PD as a research context** (21.08%), investigating the philosophy and methodology of PD. Specifically, some studies examined the *philosophical aspects of PD*, such as its concepts and values. For example, Harrington and colleagues challenged the privileged nature of traditional PD workshops, identified key areas of tension and considerations, and advocated for prioritizing the involvement of historically underserved individuals in the design process [80]. Other studies instead focused on *methodological aspects of PD*, specifically about the development of new PD methods and tools. For example, Stegner et al. presented Situated Participatory Design, a PD approach on how to effectively engage elderly people in design activities [158].

It is worth noting that these three PD functions in HCI research sometimes coexisted within certain papers. For example, while designing new solutions through the PD process (i.e., PD as a design approach to develop new solutions), some studies (e.g., [19, 40]) reflected on the design process and shared relevant design guidelines or principles (i.e., PD as a research method for exploring design spaces) in the papers' discussion sections.

4.2 Features of PD in HCI Practices

In this section, we present how the key features of PD (i.e., cooperation, political commitment, mutual learning, and creativity) were manifested in the PD practices in the analyzed papers.

4.2.1 Cooperation. For cooperation, we report four aspects: identifying who was involved in the cooperation process, understanding their roles, and examining how and where they collaborated with each other throughout the design process.

Who Were Involved. We identified three types of participants, including ***end-users*** (i.e., people who were intended to be directly influenced by the design output, such as the intended end-user of a system and the target audiences of a policy), ***other stakeholders*** (i.e., non-end-user stakeholders, such as management people, parents for children, and policymakers), and ***designers*** (i.e., people who coordinated, moderated, and facilitated PD practices, mainly the researchers of the included papers). All but one of the papers reported the active involvement of end-users in the PD process (e.g., [4]), emphasizing the central role of the collaboration between end-users and designers in HCI's PD practices. Additionally, nearly half of the papers included other stakeholders' involvement, such as engaging caregivers when designing with ADHD children [46]. Lastly, designers were identified in all the papers given their essential roles in running the reported PD activities.

In the majority of the papers ($N = 127$, 68.65%), the end-user and other-stakeholder participants were primarily individuals representing themselves and those similar to them. Approximately 29.73% ($N = 55$) of the papers involved participants at the community level, such as collaborations with residents and building managers to explore the role of smart home technologies in public housing [99]. A small number of papers ($N = 3$, 1.62%,) engaged participants at the government level or higher, such as working with municipal project leaders in the PD process [52] or collaborating with the United Nations to collectively envision future technologies for refugee children [62].

Participants' Roles. Among those involved, end-users, other stakeholders, and designers each played a variety of roles. On the **end-user** side, their roles in PD practices included being an informant, designer, evaluator, facilitator, and researcher. Specifically, the informant's role was to provide insights regarding user practices and needs, which typically occurred in the early design stage through ethnographic approaches like interviews and observations (e.g., [70, 179]). The designer role involved end-users either being as independent designers, facilitated by researchers (e.g., [139, 159]), or as co-designers working alongside with researchers (e.g., [122, 149]). As an evaluator, end-users would engage in idea evaluation, such as voting on sketches [112], assessing the functionality and usability of the developed prototypes (e.g., [125, 175]) or existing designs (e.g., [131, 177]). In some cases, end-users also took on the role of facilitator, for example, children took turns being the camera operator during the interview process with other children [116]. Finally, end-users in some studies acted as researchers, participating in the data analysis in the PD process, such as analyzing public data related to design topics together with researchers [130].

The roles of ***other stakeholders*** included being an informant, co-designer, evaluator, and facilitator. The informant's role was mainly about informing the design directions by providing supplementary perspectives to end-users' views (e.g., [66, 121]). As a co-designer, these stakeholders collaborated with end-users and/or designers to collectively participate in the design activities (e.g., [18, 123]). Regarding being an evaluator, their activities were similar to end-users, mainly engaging in idea evaluation, prototype evaluation, and design assessment. In some cases, they also provided feedback for the PD activities for researchers [9]. What's different is the stakeholders' roles as a facilitator, where they mainly supported end-users' participation, such as domain experts' helping other participants better interpret and organize the generated ideas [85].

The third group of participants, **designers**, took on three key roles: co-designer, facilitator, and researcher. As a co-designer, they worked collaboratively with end-users and/or stakeholders to jointly create new solutions. Another prominent role was facilitator, where they not only coordinated and led the PD sessions but also supported the participation of end-users and/or other stakeholders, such as orienting these participants on design skills [18], and offering technical assistance for participation and design [138]. Lastly, designers in the included papers were essentially also researchers, conducting research activities both in supporting the design activities (e.g., performing focus groups for themselves and end-users to better understand their current practices [38]) and research purposes (e.g., collecting PD process data through field notes for academic papers [105]).

Design Collaboration Patterns. We summarized three primary design collaboration approaches among different participants. The first approach is **end-users designing with designers, sometimes involving other stakeholders.** More specifically, designers, in some cases, mainly acted as facilitators and did not participate in co-creating. For example, in the design exploration to address challenges in mixed-group videoconferencing involving hearing-impaired and hearing-normal people, both groups of end-users were guided to create visual icons that could facilitate effective communication, with designers mainly facilitating the design flow and providing technical assistance [96]. In other cases, designers would join end-users and/or stakeholders for co-creating, such as jointly designing and developing an AI system for retrosynthetic route planning in synthetic chemistry with chemists [149]. The second design collaboration approach observed in the analyzed papers **involves stakeholders collaborating with designers, without the direct involvement of end-users.** For example, Ahmadpour and colleagues [6] conducted co-design activities with therapists and social workers to develop technologies that help parents teach social-emotional skills to children with trauma histories. The third type of design collaboration features **designers leading the design process, while participants served as informants or testers.** In this approach, end-users or stakeholders provided feedback or insights during the design research or evaluation stages, but did not participate directly in design decision-making (e.g., [111, 160]).

Cooperation Settings. The majority of studies were conducted in person (N = 144, 77.84%) across various physical environments, such as participants' homes [82] and science centers [132]. A smaller portion of PD took place in mixed settings (N = 19, 10.27%), combining both online and in-person design activities [54, 142]. Additionally, some PD studies were conducted entirely online (N = 22, 11.89%), utilizing platforms like Miro and Zoom [104].

4.2.2 Political Commitment. For political commitment, we focus on democracy (i.e., how end-user participants were involved in the design decision-making process) and empowerment (i.e., how end-user participants were supported regarding design goals and processes).

Democracy. Democracy in PD means those who will impacted by a design (i.e., the end-user participants) are able to influence the design decision-making process. We identified two ways in which democracy was manifested in the examined papers. First, **end-user participants directly engaged in the design decision-making process.** In some PD practices, users were fully involved throughout various design stages—from ideating to prototyping, developing, and testing—where they expressed their opinions and co-decided the final design outcome (e.g. [89, 106]). In other cases, end-user participants were involved primarily in the early ideation stage, where they generated new ideas or defined design functions. Designers then developed a prototype based on these participant-contributed solutions (e.g., [97, 175]). In this way, participants' input determined the final design, thereby supporting the democratic principle. Additionally, democracy was sometimes exercised through evolutionary prototyping, where participants contributed suggestions and proposed new features during an iterative process that refined and improved the initial prototype or mockup created by designers (e.g., [122]).

Second, **democracy was enacted in implicit ways, where end-user participants influenced designers' decision-making rather than acting as direct co-decision-makers.** In some practices, designers engaged participants in ideation activities through co-design workshops, and the resulting outputs were then analyzed by the designers to inform specific design concepts (e.g., [71, 82]). In these instances, the final design decisions were made by the designers, not the participants. Similarly, in other cases, participants primarily acted as testers of designer-created prototypes, using the prototypes to help designers better understand user interactions and refine the design (e.g., [76, 181]). Additionally, implicit democracy was common in papers that used PD as a research method to explore design spaces, where no final design solutions—such as specific concepts or functional prototypes—were developed. Instead, the outputs were presented as design guidelines, directions, and opportunities (e.g., [167, 177]). While no concrete design decisions were made in these cases, the findings have the potential to influence future design practices.

Empowerment. In PD, empowerment typically refers to the commitment to enhancing users' relevant practices, such as improving work-life quality in workplace settings [24, 29, 155]. For this dimension, we examined how user participants were empowered both in terms of design goals and design processes. Specifically, we observed two forms of **goal empowerment.** First, some PD practices had achieved *real-world, tangible empowerment* by deploying design outcomes and making them publicly accessible. For example, Correia and Tanaka have released their system for manipulating sound and images together, developed through PD activities, as open-source software [50]. Second, many PD cases, particularly those focused on exploring design spaces, aimed to propose design directions that could benefit end-users (i.e., *proposed goal empowerment*). However, these efforts often remained at the stage of understanding user needs and preferences, delivered in sketches, scenarios, or low-fidelity prototypes (e.g., [45, 62]). These outcomes did not advance to the development stage, meaning they did not produce concrete, functional design solutions. While these outputs did not directly empower participants' current practices, they hold the potential to do so in the future if the design insights are integrated into actual designs. It is important to note that in the analyzed papers, studies achieving tangible, real-world empowerment were quite rare (N = 11), with most research remaining at the ideation stage and not progressing to functional development or field deployment.

Regarding **process empowerment**, we focused on how user participants were supported during the design activities and identified three types of empowerment. The first type was *knowledge empowerment* to facilitate the design process, which specifically included enhancing user participants' knowledge of their current practices (e.g., [43, 169]), technology literacy such as relevant technological affordances and limitations (e.g., [173]), and domain knowledge around design topics like concepts about self-harm [161]. The second type is *creative expression empowerment*, which centered on supporting participants' design expression, including orienting them on the needed design concepts (e.g., designing thinking [18]) and skills (e.g., sketching techniques [103]), as well as providing appropriate design tools [144]. Third, some papers specifically emphasized *environmental empowerment* by providing a safe and conducive design environment for participants, such as facilitating relationship building among participants [55], fostering a sense of community [153], encouraging participants to freely express their

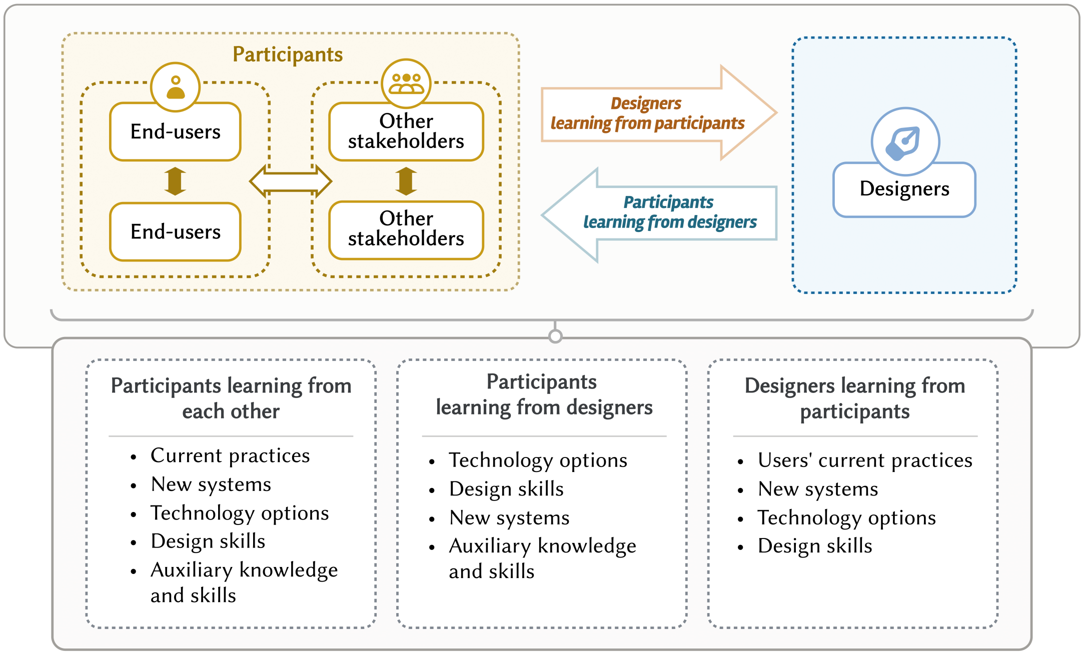

Figure 4: The identified mutual learning activities and the associated knowledge types for learning

ideas [64], and adjusting workshop approaches based on participant feedback to better meet their needs [92].

4.2.3 Mutual Learning. Mutual learning involves the exchange of knowledge between participants and designers throughout the PD process. We first present different knowledge domains for mutual learning identified from the analyzed papers, then share the details of knowledge exchange.

Different Knowledge for Mutual Learning. From the analyzed PD cases, we identified five domains of knowledge exchanged during mutual learning: user practices, technology options, new systems, design skills, and auxiliary knowledge and skills. Figure 4 provides an overview of these knowledge types, which are further elaborated below:

- **Users' current practices** refer to the knowledge about user participants' current practices, encompassing their practice contexts (e.g., the broader organizational, social, and cultural environment in which their practices occur [106]), practice details (e.g., workflow and related tasks [52]), the associated power dynamics (e.g., how hierarchical structures, authority, and power relations within the organization influence decision-making and work practices [159]), and the users' perspectives and attitudes toward their existing practices [127].
- **Technology options** pertain to the insights gained from experiencing and exploring various technological possibilities, which include 1) an overview of relevant technologies, providing a broad understanding of existing and emerging technologies, such as their capabilities, limitations, and potential applications [86], and 2) users' perspectives on technologies, such as their attitudes and understanding of these technologies [177].
- **New systems** refer to the envisioned, developed, or experienced technological solutions, consisting of two primary types: 1) imagining new design solutions, which involves the creative process of conceptualizing and ideating potential new systems or modifications to existing ones [18], and 2) prototyping and experiencing new systems, which includes the development and use of prototypes to give users and developers hands-on experience with these new systems [90].
- **Design skills** refer to knowledge of design principles, methods, and practices, particularly focusing on participants' 1) understanding of key design concepts and principles [18], and 2) familiarity with the relevant techniques needed to effectively carry out design activities [16].
- **Auxiliary knowledge and skills** refer to the additional expertise that supports participants' design process, which includes 1) domain-specific knowledge relevant to the particular area or context for which the system was being designed [161], 2) research skills, involving the ability to conduct user research and gather and analyze data [130], and 3) ICT literacy, i.e., the proficiency in effectively using information and communication technologies (ICT) like Zoom and Miro [83].

The five types of knowledge highlight clear distinctions in the learning content shared between participants and designers. We further explored which types of knowledge were mutually exchanged:

Designers Learning from Participants. Across various PD cases, designers primarily learned four types of knowledge from participants. First, they gained insights into **users' current practices**, such as practice context [52], workflows [171], and user perspectives on the practice [131]. This understanding was crucial for designers to deeply comprehend their design partners' experiences and viewpoints, which was acquired through ethnographic methods like interviews and observations with users [127]. Second, in terms of **new systems** knowledge, designers learned about participants' envisioned designs and potential opportunities through approaches such as verbal descriptions of desired solutions [42] and sketches illustrating their visions [38]. During the prototyping and system experience phase, designers further understood how new systems functioned by testing and deploying them with participants, gathering valuable insights on usability, functionality, and user feedback [7, 106, 123]. Third, designers learned about **technology options** by observing how participants interacted with existing technologies and prototypes, e.g., involving elderly people and children using VR [173], understanding the limitations of these technologies [124], exploring their potential applications [142], and gaining insight into participants' perspectives on the technologies involved [177]. Lastly, in some PD cases, designers acquired **design skills** from participants through their participation processes and reflections, such as understanding the capabilities of design tools like tool cards for facilitating user participation [36], refining design stages based on participants' feedback [64], and developing strategies to enhance participant engagement [52].

Participants Learning from Designers. Similarly, participants also learned four types of knowledge from designers. First, regarding **technology options**, participants gained an overview of technologies from designers, such as learning how to interact with new technologies (e.g., children experimenting with speech agents [174]) and discussing the possibilities of relevant technologies with designers [86]. Second, participants acquired **design skills** from designers, such as understanding design concepts like design thinking and the human-centered design process [18, 81], using specific design tools [16], and improving their prototyping skills [148]. Third, participants learned about **new systems** by exploring design possibilities through concepts and scenarios provided by designers and their own creative input [113]. They also gained relevant understanding through prototyping and experiencing these systems, learning how the involved mechanics and elements functioned [67, 108], and understanding the potential impact of new design solutions on organizational structures or practices [52]. Lastly, participants gained **auxiliary knowledge and skills** from their PD experiences, such as domain-specific knowledge related to design topics [139], research skills like data analysis [130], and improved ICT literacy [83].

Participants Learning from Each Other. In addition to the mutual learning between participants and designers, participants also learned from each other. The analyzed papers reveal that participants exchanged knowledge across all five domains. For instance, they learned about each other's **current practices**, such as organizational roles and associated power dynamics [52], the challenges they faced [54], and each other's perspectives and attitudes [123]. During design activities, participants acquired **new systems** knowledge and **technology options** by evaluating and iterating on design concepts proposed by others, thereby enhancing their understanding of potential technological opportunities [87, 174]. Additionally, collaboration helped participants develop **design skills**, such as effective communication and design expression [81]. Lastly, participants also shared and gained **auxiliary knowledge and skills,** e.g., historians might share unique historical details that inspired new ideas in the PD process [161].

4.2.4 Creativity. For creativity, we examine whether new design ideas were generated, the forms these ideas took, and who generated them. We also explored how these new design ideas emerged through reflection-in-action.

Creativity Formats. In the examined design practices, different types of creativity outputs were generated, mainly including computer systems (e.g., [95, 175]), services (e.g., learning objectives [14] and hospital service [52]), and communication norms (e.g., [39]). We summarized four distinct ways in which participants expressed their creativity:

- **Oral expression**, where participants expressed their new ideas or suggested improvements to existing designs through verbal communication in the design ideation and evaluation phases (e.g., [61]). This form of creative expression was also present in collaborations with special groups, such as individuals with disabilities, where designers assisted participants in translating their verbal ideas into sketches (e.g., [67]).
- **Visual presentation**, where participants visualized their ideas through drawing, sketching, and role play, using formats such as text descriptions [66], storyboards [164], scenarios [44], interface wireframes [5], crafts [168], and videos [47]. The tools used often included paper, pens, sticky notes, craft materials, and digital collaboration platforms like Miro Board [36].
- **Mock-up prototypes**, where participants concretized their ideas through hands-on making activities to generate prototypes. The first type of prototypes offered simple, conceptual-level presentations of participants' creativity, enabling broad exploration of potential design solutions, such as paper prototypes [128], handcrafted models [81], and LEGO brick constructions [71]. Another group of prototypes, including medium-fidelity [163], high-fidelity [9], and Wizard-of-Oz prototypes (e.g., [40, 43]), focused on providing detailed, moderately to highly realistic interactions to test and refine specific design features or user interactions.
- **Functional systems** involved participants in the development of systems that could achieve or simulate the major characteristics of the final product. Such systems were intended for functional testing with real users for further development and iteration. Note in some PD studies, designers created the functional systems before the PD sessions (e.g., [181]), and these systems were then used during the sessions for concept validation and further refinement (e.g., [50, 132]).

Reflection-in-Action. Rather than free brainstorming, design practices in PD emphasize reflection-in-action, a creativity generation process that builds on participants' current practices through mutual learning and designing by doing [13, 32, 151, 157]. On one hand, we found that participants' creativity emerged out of their relevant experiences through mutual learning during the PD process, using various methods such as interviews, focus groups, observations, surveys, and design sessions, as detailed in section 4.2.3 on mutual learning. On the other hand, many PD practices also involved participants in designing-by-doing, namely hands-on making activities for creativity expression, especially in the cases of creating mock-up prototypes and functional systems mentioned above (e.g., [17, 181]). However, connecting to users' current practices and designing-by-doing were not always evident in the analyzed papers. For instance, some practices only guided participants to reflect on their relevant experiences and generate ideas through oral expression or sticky notes without designing by doing (e.g., [105, 179]). In other cases, participants were directly engaged in designing and evaluating new systems in controlled settings without being guided to explicitly connect to their current relevant practices (e.g., [96, 181]).

5 Discussions

We provide an overview of recent PD applications in HCI research over the past decade. Through our analysis, we summarize different PD application scenarios, identify three functions of PD in HCI research, and share how different PD features were manifested. In this section, we recap some key findings and reflect on their implications for employing PD in HCI work.

5.1 Characteristics of PD Applications in HCI

Our findings indicate that PD serves three primary functions in HCI research: as a research method to explore design space, as a design approach for creating new solutions, and as a research context to broaden the theoretical and methodological framing of PD. These functions align with PD research practices reported at the Participatory Design Conference (PDC) [78], where researchers and practitioners primarily apply PD in new domains, especially in healthcare and education. Additionally, researchers in both the PDC and HCI communities have dedicated efforts to developing new methods and tools for PD, as well as deepening its theoretical understanding. In this regard, our work, along with Halskov and Hansen's review of PDC papers from 2002 to 2012 [78], highlights the adaptability of PD and the growing interdisciplinary interest in applying, understanding, and expanding PD. At the same time, unlike the PDC community, which focuses more on exploring PD in new domains, methods, and fundamental concepts [78], our findings show that most HCI papers utilized PD as a method to explore design spaces and develop new technologies. This difference can be attributed to the nature of HCI research, which centers on technologies for humans. Nevertheless, it is important to note that PD is not new to HCI. Instead, it is deeply rooted in the field—early Scandinavian PD practices involved designing computer systems for workers [20, 63], which is essentially an HCI practice. Considering the numerous instances of PD applications in HCI, we encourage HCI scholars to move beyond viewing PD merely as a design method but can contribute to the theoretical and methodological development of PD by reflecting on their PD practices and outcomes. This mindset is particularly relevant in the current AI boom, where technologies are becoming more intelligent and autonomous in their interactions with humans [10, 176]. PD could play a crucial role in designing AI technologies that prioritize human agency over machine dominance.

Our findings also show that HCI scholars have applied PD across various areas, such as healthcare, sustainability, and education. However, these practices mostly align with Bødker & Kyng's criticism that current PD efforts tend to *"focus on the here-and-now without considering what happens after a project"* [33, p. 6]. Specifically, most PD practices we analyzed addressed immediate, smaller issues while neglecting broader challenges that could lead to significant social impact or long-term benefits for participant groups. For example, the majority of the PD practices reviewed in our study served research purposes, with only a small fraction (11 out of the 185 papers, e.g., [11, 15, 50, 52, 168]) deploying the final design outputs that benefited the intended public. This *"here-and-now"* focus and *"low technological ambition"* [33] may be partly due to the fact that most of the HCI practices we examined were conducted at the individual level, led by researchers, with limited collaboration with social or governmental organizations that could amplify their impact. For example, we identified only three papers in our pool that described PD collaborations at the governmental level or higher [5, 52, 62]. This tendency to concentrate on small-scale, immediate issues is not a new challenge for PD. Kensing and Blomberg, in 1998, raised similar concerns, noting that PD practices often focused on the *"individual project arena"* with significantly less engagement at the company, organizational, or national levels [93]. Our findings indicate that this *"individual project arena"* focus persists today, at least within the HCI community. Therefore, **we echo the calls of Bødker & Kyng, along with other scholars, for a repoliticization of PD to *"face the big issues"* and conduct PD that matters – aiming for high technological ambitions, deploying working prototypes, forming alliances with other stakeholders, scaling up ideas and results, and embracing PD as a form of action research** [93, 107].

Lastly, most of the identified HCI PD cases in SIGCHI conferences come from the USA and UK (see Figure 2(c)), highlighting that PD research and practices in HCI are predominantly conducted in Western contexts. Such an unbalanced region distribution suggests that our findings, or the current understanding of PD in HCI, are largely shaped by a Western-centric perspective, with limited representation from other regions and cultural settings. It is important for readers to recognize this bias, as it may overlook diverse cultural contexts and local nuances when PD is implemented in non-Western regions, potentially reinforcing existing inequalities and marginalizing non-Western voices about PD. We therefore encourage future research to specifically examine PD practices and perspectives in non-Western contexts to complement and broaden the current Western-centric understanding of PD reported in this paper.

5.2 Features of PD's Key Dimensions in HCI and Their Implications for Future Practices

In this section, we revisit our key findings from analyzing the four dimensions of PD—cooperation, political commitment (i.e., democracy and empowerment), mutual learning, and creativity—and discuss their practical implications for integrating PD into HCI work.

5.2.1 Cooperation. Most practices in the examined papers involved end-users in PD activities, and about half of the studies also included stakeholders such as domain experts, parents, and managers [15, 52]. Involving a broad range of stakeholders is a traditional PD practice. For example, PD approaches in the 1990s had already expanded from working solely with unions and workers to include other stakeholders like management in the workplace [119, 147]. Despite this long-standing practice, emphasizing diversity in stakeholder participation remains crucial. Research has shown that involving diverse stakeholders brings numerous benefits, such as providing varied perspectives and experiences, enriching the research content, and enhancing the design outputs' practical applications and policy impact [25]. Therefore, we suggest that future PD practices involve a wider range of stakeholders beyond just end-users, especially extending to community, organizational, and governmental levels to increase real-world impact (e.g., [52]).

We also identified two distinct approaches to design collaboration: 1) participants designing, with designers acting as facilitators, and 2) participants co-designing with designers. In early PD practices, participants primarily co-designed with designers and developers [31, 48]. However, in our study, we found that the first approach, where designers acted as facilitators, was more prevalent in HCI research, which can be attributed to the fact that many studies utilized PD to explore the design space. In such studies, end-user input was crucial as researchers aimed to understand users' perspectives on new technologies or their desired solutions to their challenges, rather than relying on designers' perspectives. By handing over creative control to participants, researchers allowed them to take the lead in expressing their ideas and attitudes. Such shift in design collaboration indicates that **in current HCI research, PD is more often viewed and employed as a research method to probe new user knowledge rather than as a design practice to create tangible, real-world solutions.**

As the findings show, PD can serve different functions in HCI research, which can guide the selection of appropriate design collaboration styles between participants and designers. Specifically, for PD practices aimed at investigating design spaces—such as understanding users' perspectives, needs, and desired solutions (e.g., [38, 55, 67])—designers can adopt more supportive roles, creating flexibility and space for participants to express their ideas. Conversely, if a PD project aims to develop actual design solutions, not just ideation, designers are suggested to act as co-designers rather than merely facilitators. In this role, they not only facilitate participants but also actively participate in the design process as co-creators, which will foster deeper mutual learning between participants and designers and helps mediate between diverse user needs and technological possibilities [73, 136], resulting in more effective design outcomes. Additionally, it is also worth noting that while we have identified different types of cooperation, such as face-to-face/online workshops, hackathons, and crowdsourcing sessions, these processes are often dynamic and nuanced, and may not always appear in distinct or clearly defined cooperation forms. Such subtle forms of cooperation and user participation, similar to the often overlooked contributions of crowd workers and end users in data generation and machine learning [152], can go unrecognized or underappreciated. Therefore, we urge HCI researchers to pay close attention to the different forms of participation and acknowledge more subtle ways of engagement, eventually avoiding the exploitative nature of user involvement.

5.2.2 Political Commitment. Across the examined papers, two types of democracy were identified: ender-user participants either took part in design-decision-making (e.g., leading the design process [77] and co-deciding with designers [149]) or influenced designers' decision-making (e.g., informing designers by providing feedback, perceptions, and desires [114]). Classical PD literature highly emphasizes *"full participation,"* where participants go beyond merely acting as informants and are involved in all design stages as co-designers (e.g., [31, 41, 58, 60, 147]). Indeed, involving participants only to influence designers' design decisions without granting them a co-decision role undermines the democratic commitment of PD—when designers make the final decisions on behalf of participants, it can result in misunderstandings of the participants' actual needs and desires, ultimately leading designers to prioritize their own preferences. Moreover, when participants' collaborative efforts are seen merely as providing information, it blurs the distinction between PD and other human-centered design methods like User-Centered Design [3]. In sum, full user participation not only ensures that user competencies are central to the design, achieving practical benefits [28, 58, 60], but also serves as an effective approach to achieving democracy through power-sharing between participants and designers [147]. As such, for future PD practices in HCI, we advocate for **supporting participants with direct and explicit democratic engagement by involving them as co-decision-makers in the design process, rather than merely influencing designers' decision-making.**

Regarding empowerment, we identified two types: empowerment through the design process and empowerment through design goals. Design process empowerment, such as supporting participants' creative expression [12] and creating safe environments [47] for design, was identified in almost all papers. Goal empowerment, on the other hand, focuses on creating a better future for the intended user groups through new designs. However, explicit goal empowerment—designing and deploying the generated design solutions to benefit broad user groups in the real world—was rarely observed in the examined PD practices. Most papers envisioned alternative better futures by delivering design opportunities, directions, and guidelines through PD (e.g., [42, 77]). In other words, most of the reviewed PD practices remain in the research phase and are presented as explorations of design opportunities and guidelines. While these practices have the potential to impact other researchers' and designers' real-world design applications in the future, they themselves are limited in directly benefiting their intended user groups. Therefore, we encourage **more future PD practices that go beyond research to achieve real-world empowerment by developing and deploying functional design solutions.**

5.2.3 Mutual Learning. Through our analysis, we identified five distinct types of knowledge for mutual learning between participants and designers in the PD process, including knowledge about User Present Practice, New Systems, Technology Options, Design Skills, and Auxiliary Knowledge and Skills. On one hand, these findings align with previous research that summarizes different types of knowledge exchanges for PD's mutual learning, including

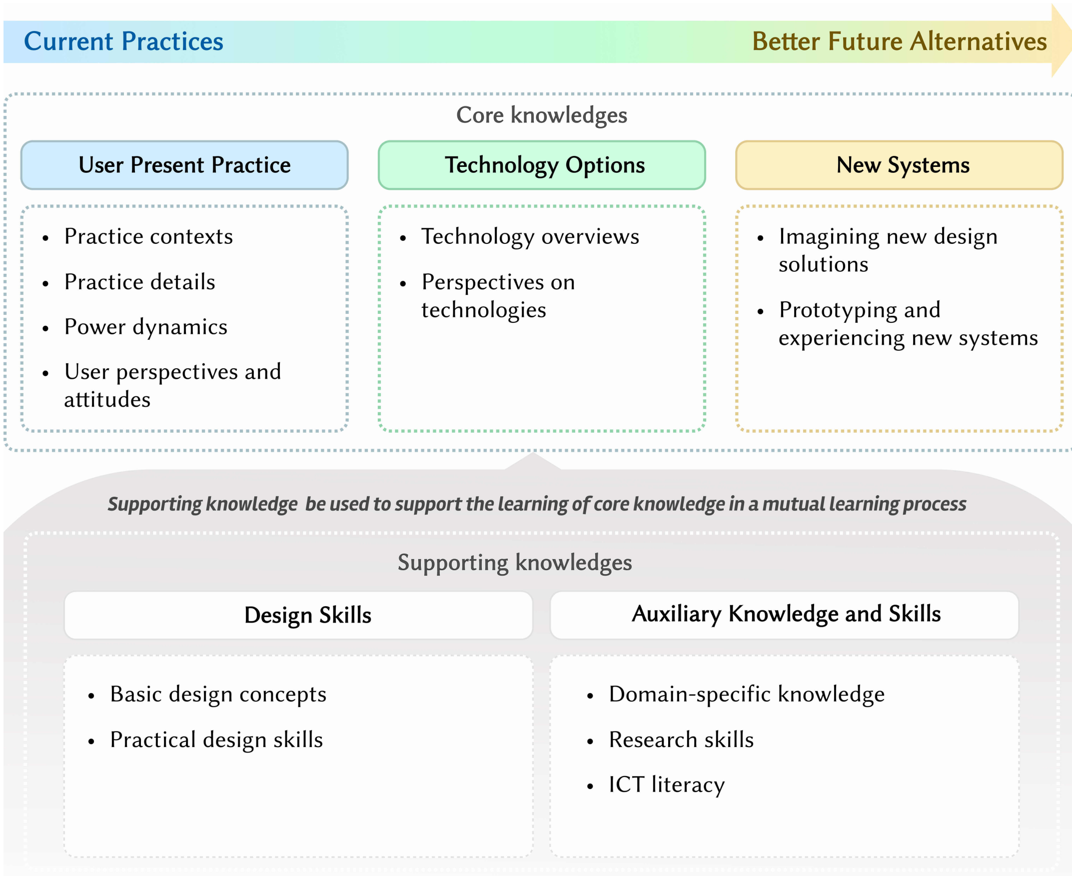

Figure 5: Five types of knowledge exchanged between participant-designer mutual learning

knowledge about users' current work, new systems, and technological options (e.g., [94, 147, 155]). On the other hand, we enhance the understanding of these knowledge types by adding specific knowledge areas within each category. For example, we systematically summarized knowledge areas that designers should learn about users' current practices, including their practice contexts, practice details, power dynamics, and perspectives and attitudes. Moreover, our findings expand the existing framing of mutual learning by making two more knowledge types explicit that are not covered in previous mutual learning frameworks [94]: Design Skills, and Auxiliary Knowledge and Skills. The two types of knowledge are not new, as they have been essential in most PD practices in the past, and present, and will continue to be in the future. However, we believe it is productive to make them explicit at this point for two reasons. First, as PD expands into new domains, especially within interdisciplinary communities like HCI, participants may lack domain-specific knowledge, necessitating focused mutual learning to ensure effective engagement (e.g., [139]). Second, the development of new design tools and techniques requires participants to learn how to use them effectively to enhance their participation.

Building on Kensing and Munk-Madsen's framework of knowledge types for mutual learning [94] and our findings from PD cases in HCI, we propose a new mutual learning framework that categorizes the different types of knowledge exchanged between participants and designers in PD. As illustrated in Figure 5, the framework consists of five knowledge types identified from our analysis, organized according to the design process—from understanding current user practices to designing better alternative futures. Each of these knowledge types includes a subset of specific knowledge areas, which are explained below:

- ***User Present Practice***, which focuses on the current practices, activities, and experiences of end-user participants. This knowledge type further includes *practice contexts* (e.g., environmental, cultural, and organizational contexts), *practice details* (e.g., tasks, activity flows, and relevant challenges), the associated *power dynamics* between relevant stakeholders (e.g., hierarchical and power relationships), and *user perspectives and attitudes* regarding their current practices (e.g., perceptions and preferences).
- ***Technology Options***, which involves understanding existing technological options for participants to stimulate their imagination of new designs. This knowledge type further constitutes *technology overviews* (e.g., relevant current technologies and emerging ones) and *perspectives on technologies*

(e.g., hands-on experiences, reflections, and attitudes about the technologies).

- ***New Systems***, which refers to knowledge about new design solutions. This knowledge type is supported by 1) *imagining new design solutions* through ideation and envisioning future possibilities, and 2) *prototyping and experiencing new systems*, where participants gain hands-on knowledge by interacting with and experiencing these new systems.
- ***Design Skills***, i.e., the knowledge about the design concepts, methods, and tools required to successfully implement PD. This knowledge type specifically includes understanding *basic design concepts* (e.g., design thinking and processes) and *practical design skills*, such as using specific design methods and tools.
- ***Auxiliary Knowledge and Skills***, referring to additional knowledge and skills that support PD activities. This knowledge type often includes *domain-specific knowledge* related to design topics (e.g., background and professional knowledge about the topics and issues), *research skills* for supporting mutual learning and designing activities such as data analysis skills, and *ICT literacy* required for effectively participating in design activities (e.g., how to use technologies like iPads and Miro Board).

By thoroughly summarizing these various learning dimensions and the specific domains of knowledge within each dimension, our taxonomy enhances the theoretical understanding of mutual learning in PD. We believe this expanded knowledge taxonomy provides a valuable reference for HCI scholars and beyond who are interested in conducting PD, helping them deepen their understanding of mutual learning and guiding the effective planning of PD activities that promote mutual learning between participants and designers.

5.2.4 Creativity. The findings on design collaboration reveal that in the analyzed practices, user participants often led creativity generation, with designers primarily acting as facilitators. While this approach maximized user participants' creativity, it might miss the opportunities to generate new ideas through the collective creativity that could emerge from deeper collaboration between different stakeholders and designers. By not fully utilizing the collective wisdom and diverse perspectives of various design partners, such studies may have constrained the richness of their design outcomes, resulting in harmonious but possibly lacking diversity and innovation. Some researchers might be concerned about potential conflicts of interest and differing ideas when various stakeholders and designers co-create. However, PD literature has long emphasized the importance and value of embracing conflicts among design partners and creating *"agonistic public spaces"* during PD activities to foster a more productive design process [21, 31]. As Björgvinsson and colleagues suggested, participants with diverse perspectives and interests can engage in constructive conflict and debate, which promotes democratic dialogue and drives innovation through the negotiation of their differences [21]. For example, in Scandinavian PD projects, conflicts and contradictions between workers, management, and developers were considered valuable resources for the democratic design process [73]; and Kyng [100] observed that these conflicts were not obstacles but productive elements that could propel the design process forward. With this in mind, we recommend **adopting a more open-minded approach to PD in HCI by involving diverse design participants (e.g., different end-user groups, relevant stakeholders, and designers), embracing conflicts and the negotiation of interests, and ultimately harnessing the full potential of collective creativity.**

Another important finding related to creativity is that not all the examined design practices were based on reflection-in-action. Notably, there is a common understanding in PD practice that creativity should be generated through reflection-in-action, i.e., a reflection process based on participants' existing practices through mutual learning and the ongoing design-making process [27, 32, 59, 151, 157]. Marc Steen described this process as *"reflexivity"* and framed it as *"a type of reflection on practices in which one is actively involved and on one's own involvement in these practices"* (P. 958), rather than detached reflection (i.e., free brainstorming and making) [157]. However, the findings show that in some of our analyzed cases, participants were directly guided to create things without linking the process to their relevant experiences, or they were asked to verbalize their design ideas without being involved in hands-on design activities. Such a lack of commitment to reflection-in-action in the creative process diverges from the core spirit of creativity in PD. It creates a situation where participants miss opportunities to propose, articulate, question, and reflect on various aspects of the evolving design. This, in turn, leads to a limited or incomplete designers' understanding and incorporation of users' practices, desires, and needs [146]. Therefore, we highly recommend **HCI scholars to reengage with the reflection-in-action principle for creativity in future PD-based design and research practices.**

To sum up, our findings on the four dimensions of PD features in HCI provide the community with a comprehensive and up-to-date understanding of PD's key concepts, principles, and applications in current HCI research. Rooted in the traditional values of PD while reflecting contemporary HCI practices, these insights highlight how PD has progressed and evolved within the field. Such a systematic and current understanding can help HCI researchers more effectively interpret and apply PD in their work, ultimately supporting its continued development as a research and design method within HCI and beyond. In closing this section, we also urge HCI researchers and practitioners to be mindful of the potentially exploitative dynamics that can arise under the principles of *"openness"* and *"sharing"* in PD's design participation, especially in the context of racial capitalism [1, 159]. For instance, users' input may be treated merely as a resource for system improvement, offering only token consultation or superficial feedback, while decision-making power remains with those holding economic or technical authority. This dynamic can obstruct genuine cooperation and democracy, particularly in commercial contexts where user participation and mutual learning may serve profit-driven motives rather than community empowerment [159]. That being said, existing PD techniques might unintentionally reinforce power imbalances, leading to inequitable outcomes [152]. Therefore, HCI researchers should be cautious, recognizing that while PD creates pathways to inclusivity, it also inherits systemic structures that can limit democratic design practices through exploitation [2].

5.3 Misconceptions of PD and Implications

As the last part of our discussion, we reflect on existing misconceptions of PD in our analyzed cases, hoping to make the boundary of PD clearer for the HCI community.

Overlooking the Political Commitment to Democracy and Empowerment. Rooted in a tradition that centers democracy and empowerment, the political principle of democracy is the cornerstone of PD and what sets it apart from other human-centered design methods [29, 30, 63, 147, 151]. However, some HCI cases have failed to uphold this fundamental political principle, yet still labeled themselves as PD. Specifically, certain practices did not involve end-user participants in the design process (e.g., [6]) or simply treated participants as design informants or testers (e.g., [125]), thereby violating the democratic principle that those affected by a design should have a voice in the decision-making and should be genuinely empowered [29, 63, 78, 118]. The design focus, objectives, and implementation of PD projects should be collaboratively and democratically negotiated between participants and designers, rather than being assumed or imposed by designers [24]. Design practices that lack this political commitment might be more accurately described as "co-design," a less political term that broadly refers to the collective creativity of designers and non-designers working together in the design development process [141].

Narrowly Equating PD to Design Ideation or Prototyping. PD is a holistic design development process that emphasizes full user participation throughout the entire design journey, including jointly setting design objectives, collaboratively analyzing the current situation, co-constructing problem formulations, co-designing solutions, and iterating through testing and deployment [31, 73, 140, 147, 155]. However, in some of the cases we examined, only the workshop sessions were labeled as PD, while other crucial activities were treated separately from PD. For example, some treated PD as a standalone workshop, excluding earlier sessions focused on understanding participants' current practices through interviews and observations [110], as well as later user testing after prototyping [125], from the PD process. This reflects a common misunderstanding of PD as merely user participation or workshops [79]. Such an overly narrow interpretation overlooks the fact that PD is a comprehensive, iterative design process requiring user engagement beyond just individual stages of design.

Introducing Unnecessary PD Terminologies. We observed that some papers introduced redundant PD terminologies, such as *"Iterative Participatory Design"* [106] or *"User-Centered Participatory Design"* [173]. However, these terms are unnecessary. PD has always been an iterative design process since its inception [63, 73, 155] and PD, as an extreme form of human-centered design that involves participants as co-design decision makers, makes the prefix "user-centered" unnecessary. These misunderstandings may arise from a lack of fundamental understanding of the PD concept among some researchers. We are not suggesting that new PD terminologies should not be created—such an approach would hinder PD's development. Rather, we encourage researchers to gain a deeper understanding of PD before proposing new terms.

In summary, these misconceptions often arise from a lack of attention to PD's fundamental concepts and core features. As design researchers and educators in HCI, we want to emphasize the importance of **promoting design literacy within the HCI community,** particularly basic knowledge about different design methods and terminologies. Given that design is a widely adopted and applied research and practice approach in HCI, we believe it is crucial to foster a wider and deeper understanding of relevant design concepts within the community. Lastly, we also encourage researchers new to design to approach its incorporation into their work with greater care and seriousness.

5.4 Limitations

We mainly see three major limitations of the current work. First, methodologically, our analysis of PD features may not fully capture all aspects of the practices described in the included papers due to varying levels of empirical detail provided by each paper. For example, we could not fully assess instances of mutual learning since we were unable to directly ask participants about their experiences. This is why we chose not to quantify the PD features. Nevertheless, our analysis remains valid based on the descriptions of PD processes and activities provided. Second, most of our sampled PD cases in HCI are Western-centric, particularly from the US and UK, which may have marginalized PD perspectives from other regions and cultures in our findings. Third, while we acknowledge variations in PD values outside Scandinavian contexts, our perspective is heavily influenced by the Scandinavian PD tradition, which might have limited our ability to fully recognize diverse PD values in non-Scandinavian contexts, potentially overlooking *"minoritarian ways of knowing"* [34]. Therefore, future research can specifically examine PD practices and perspectives from non-Western contexts.

6 Conclusion

We sampled and analyzed how HCI scholars have utilized PD in their research, focusing on two key aspects: the characteristics of PD applications and how PD features were manifested. Our findings provide a comprehensive overview of PD as a research and design method in HCI, offering insights into its primary functions in HCI studies and examining how its core principles have been either upheld or overlooked. Based on these insights, we critically reflect on the conceptual understanding of PD within the HCI community and address potential misconceptions about it. Ultimately, we hope this work will deepen HCI scholars' understanding of the PD approach and serve as a reference guide for researchers interested in integrating PD into their design and research practices.

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7 APPENDICES

Table 4: The major features of PD in representative PD literature over time

Literature	Design Contexts	Participants	Major Features
(Floyd et. al, 1989) [63]	Computer systems in the workplace	Trade unions, workers, technology designers/developers	**Humanization** (The system is designed to compensate for human weaknesses and support human strengths) **Democratization** (The system reflects the interests of those affected; interest-governed co-determination in the conception and design) **Mutual learning** (Users and developers communicate and learn from each other) **Designing by doing** (Experimentation, prototyping, testing, etc.)
(Blomberg & Henderson, 1990) [24]	Computer systems in the workplace	Users and developers	**Empowerment** (P.354 – *"The goal is to improve the quality of work life"*) **Collaborative** (P.354 – *"Developers and users work together to design and develop the technology"*) **Iterative** (P.354 – *"Design should be an iterative process where emerging design ideas are tried out in real work situations"*)
(Muller et al., 1991; Muller et al., 1993) [118, 119]	*"Technologies in workplaces, communities, homes, and social institutions"* (1993, P.26)	Users and other stakeholders, designers	**Democratic** (1991, P.391 – *"Participation in decision-making by the people who will be affected by the design decisions"*; 1993, P.27 – *"Direct and effective worker participation (not mere 'involvement') in design activities and decision"*) **Empowerment** (1991, P.389 – *"Improving the quality of the working lives of those for whom we design technologies"*) **Collaborative** (1991, P.389 – *"Involving the users in the collaborative development of new technologies"*) **Iterative** (1991, P.389 – *"Providing opportunities to iterate the design"*)
(Schuler & Namioka, 1993) [147]	Computer systems in the workplace	User, trade unions, developers, managers	**Democratic** (P.42 – *"Every human should have the right to participate equally in decisions concerning his or her life"*) **Cooperative** (P.31 – *"More active involvement of users and developers in the design process"*) **Empowerment** (P.31 – *"Creating and fostering an environment where they can feel empowered to express their ideas"*) **Pragmatic** (P.41 – *"The participation of skilled users in the design process can contribute importantly to successful design and high-quality products"*) **Mutual Learning** (A process-oriented paradigm focusing on human learning and communication)
(Bødker et al., 1995) [31]	Computer systems in the workplace and other settings	Users, managers, designers/developers	**Empowerment** (P.2 – Computer systems should *"enhance workplace skills"* and are *"designed to be under the control of the people using them, supporting work activities without making them more rigid,"* and *"to improve the quality of results"*) **Democratic** (P.2 – *"To be designed with full participation from the users—both from a democratic point of view and to ensure that competencies central to the design are represented in the design group"*) **Embracing Conflicts** (P.2 – *"Conflicts are an inherent aspect of this process…conflicts may be turned into resources"*) **Cooperative** (P.11 – *"a design process where both users and designers actively and creatively participate, leveraging their different qualifications"*)
(Spinuzzi, 2005) [155]	Artifacts, systems, work organizations, and knowledge in the workplace	Users, designers/researchers	**As a research method** (Participatory design is research, a way to understand by doing) **Democratic** (P.164 – *"Participants' cointerpretation of the research is not just confirmatory but an essential part of the process"*) **Empowerment** (P.166 – *"Users' knowledge is described so that it can be used to design new tools and workflows that empower the users"*) **Cooperative** (P. 167 – *"Participatory design emphasizes co-research and co-design: researcher-designers must come to conclusions in conjunction with users"*)

Table 4: The major features of PD in representative PD literature over time (Continued)

Literature	Design Contexts	Participants	Major Features
(Törpel, 2009) [165]	Computer systems	Users, designers/developers	**Democratic** (P.14 – *"The direct participation of those whose (working) lives will change as a consequence of the introduction of a computer application"*) **Pragmatic** (P.14 – *"future work… is most beneficial and efficient, and the resulting products are good and the employed technology is appropriate"*) **Cooperative** (P.15 – *"Multiple viewpoints and taking differences seriously as facts and resources"*) **Empowering** (P.15 – *"Empowering weak and/or marginalized societal groups as part of ICT design"*) **Authentic Experience** (P.15 – *"'Being there' instead of 'talking about' and 'developing for'"*) **Hands-on Methods** (P.15 – *"Real-world problems with real-world solutions that get achieved by hands-on methods and activity"*) **Reflective** (P.15 – *"Reflective practice in all those areas of practice where relations of design and use of computer applications are of importance"*)
(Sanders et al., 2010) [140]	ICT, space design, product development, industrial design, architecture, service- and transformation design	Non-designers (potential users, other external stakeholders), designers	**Cooperative** (P.195 – *"PD processes usually involve many people having different backgrounds, experiences, interests, and roles within the project"*) **Empowering** (P.195 – *"How non-designers can articulate design proposals in such a way that these can provide a starting point for subsequent professional development work"*)
(Björgvinsson, 2010) [21]	Public sphere and everyday life	Users and designers	**Democratic Innovation** (User-driven design and innovation in a process that is inclusive, participatory, and reflective of a broad spectrum of societal needs and values) **Things** (i.e., what is being designed, P.41 – *"Socio-material assembly that deals with 'matters of concern'"*) **Infrastructuring** (Meaning the ongoing, collaborative process of creating and maintaining the socio-technical systems and networks for PD) **Agonistic Public Spaces** (Diverse stakeholders with differing perspectives and interests can engage in constructive conflict and debate, fostering democratic dialogue and innovation through the negotiation of their differences)
(Steen, 2011; Steen, 2013) [156, 157]	Computer systems	Users, designers, researchers, and other stakeholders	**Cooperation** (2011, P.172 – *"A cooperation virtuoso aims to promote cooperation between diverse people—which will enable them to engage in curiosity and creativity"*) **Curiosity** (Mutual learning, 2011, P.172 – *"A curiosity virtuoso is open towards other people and their experiences and is able to empathize with other people, especially during the process of exploring and articulating the problem"*) **Creativity** (2011, P.173 – *"A creativity virtuoso is open towards other people and their ideas and is able to productively combine different ideas, especially during the process of generating and trying-out possible solutions"*) **Empowerment** (P.956 – *"A disposition and a willingness to share power with others, especially with prospective 'users', and to 'let go' of control—when appropriate, which depends on the situation"*) **Reflexivity** (P.958 – *"Refer to a type of reflection on practices in which one is actively involved and on one's own involvement in these practices"*)
(Simonsen and Robertson, 2013) [151]	Computer systems ("Information technologies")	Users and designers	**Democracy** (P.2 – *"An unshakable commitment to ensuring that those who will use information technologies play a critical role in their design"*) **Mutual Learning** (P.3 – *"A process of mutual learning for both designers and users can inform all participants' capacities to envisage future technologies and the practices in which they can be embedded"*) **Empowering** (P.4 – *"Participatory Design has always given primacy to human action and people's rights to participate in the shaping of the worlds in which they act"*)

Table 4: The major features of PD in representative PD literature over time (Continued)

Literature	Design Contexts	Participants	Major Features
(Halskov & Hansen, 2015) [78]	Different domains and areas, e.g., technology design, civic engagement, museum exhibition)	Users, designers, and other stakeholders	**Politics** (P.89 – *"People who are affected by a decision should have an opportunity to influence it"*) **People** (P.89 – *"People play critical roles in design by being experts in their own lives"*) **Context** (P.89 – *"The use situation is the fundamental starting point for the design process"*) **Methods** (P.89 – *"Methods are means for users to gain influence in design process"*) **Products** (P.89 – *"The goal of participation is to design alternatives, improving quality of life"*)
(Bødker & Kyng, 2018) [33]	Computer systems ("IT" and "technology")	Users (partners), researchers	**Facing the Big Issues** (P.15 – *"PD that Matters Should Address Changes that Matter"*) **Cooperation** (P.15 – *"PD that Matters is Based on Engaged Partners"*) **Political** (P.16 – *"PD Researchers Should be Activists"*) **Lasting Impact** (P.17 – *"PD that Matters Should have a Vision for High and Lasting Impact"*) **Democratic Control** (P.18 – *"PD that Matters Strives for Democratic Control of IT"*)
(Bødker et al. 2022) [29]	Computer systems ("digital technologies") in work practices or everyday life	Users, designers, researchers	**Democracy** (P.2-3 – *"People can influence digital technologies that will change their work practices or everyday life"*) **Cooperation** (P.3 – *"Users, designers, and researchers collaborate toward shared goals"*) **Mutual Learning** (P.7 – *"Participatory Design aims for emancipatory practices rooted in mutual learning between designers and people"*) **Empowerment** (P.3 – *"We focus on empowerment of people not only as individuals but as part of their groups and communities, both as they are currently established and for the (possible) future"*) **Human Beings as Skillful and Resourceful** (P.7 – *"Seeing human beings as skillful and resourceful in the development of their future practices"*)

Table 5: The full list of ACM SIGCHI conferences

Conferences	Conference Homepages
ACM Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutoUI)	https://dl.acm.org/conference/automotiveui
ACM Creativity & Cognition (C&C)	https://dl.acm.org/conference/c-n-c
ACM Conference on Human Factors in Computing Systems (CHI)	https://dl.acm.org/conference/chi
Annual Symposium on Computer-Human Interaction in Play (CHI Play)	https://dl.acm.org/conference/chi-play
ACM Collective Intelligence Conference (CI)	https://dl.acm.org/conference/ci
ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies (COMPASS)	https://dl.acm.org/conference/COMPASS
ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW)	https://dl.acm.org/conference/cscw
ACM Conversational User Interfaces (CUI)	https://dl.acm.org/conference/cui
ACM Designing Interactive Systems (DIS)	https://dl.acm.org/conference/dis
ACM SIGCHI Symposium on Engineering Interactive Computing Systems (EICS)	https://dl.acm.org/conference/eics
ACM Symposium on Eye Tracking Research & Applications (ETRA)	https://dl.acm.org/conference/etra
ACM International Conference on Supporting Group Work (GROUP)	https://dl.acm.org/conference/group
ACM/IEEE International Conference on Human-Robot Interaction (HRI)	https://dl.acm.org/conference/hri
International Conference on Multimodal Interaction (ICMI)	https://dl.acm.org/conference/icmi-mlmi
ACM Interaction Design and Children Conference (IDC)	https://dl.acm.org/conference/idc
ACM International Conference on Interactive Media Experiences (IMX)	https://dl.acm.org/conference/imx
ACMInternational Conference on Interactive Surfaces and Spaces (ISS)	https://dl.acm.org/conference/iss
ACM Conference on Intelligent User Interfaces (IUI)	https://dl.acm.org/conference/iui
ACM International Conference on Mobile Human-Computer Interaction (MobileHCI)	https://dl.acm.org/conference/mobilehci
ACM Conference on Recommender Systems (RecSys)	https://dl.acm.org/conference/RecSys

Table 5: The full list of ACM SIGCHI conferences (Continued)

Conferences	Conference Homepages
ACM Symposium on Spatial User Interaction (SUI)	https://dl.acm.org/conference/sui
ACM International Conference on Tangible, Embedded and Embodied Interaction (TEI)	https://dl.acm.org/conference/tei
ACM Symposium on User Interface Software and Technology (UIST)	https://dl.acm.org/conference/uist
ACM Conference on User Modeling, Adaptation and Personalization (UMAP)	https://dl.acm.org/conference/umap
ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp/ISWC)	https://dl.acm.org/conference/ubicomp
ACM Symposium on Virtual Reality Software and Technology (VRST)	https://dl.acm.org/conference/vrst