Bridging the Gap: Using a Preparatory Stage to Reduce the Knowledge Gap caused by Generational and Educational Disparities in Participatory Design

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Abstract

Background   Designers face the challenging task of improving participatory design (PD) activities to allow the participation of different stakeholders, especially in the presence of participation gaps, which can be a reality in any project with generational or educational disparities. This research inquires how preparatory stages can assist in bridging the knowledge gaps between participants of PD projects caused by their differing educational and generational backgrounds. A case study is conducted with the aim to reduce participation gaps in a participatory experience with 29 citizens who took part in digital social innovation (DSI) projects organized by the Seoul DSI center, South Korea.

Methods   We designed a ten-week (35-hour) social innovation training program as a preparatory stage to reduce citizens' participation gaps before they embark on DSI projects. We evaluated the preparatory stages by collecting mixed data: observations and surveys during the preparatory stage and interviews with five participants at the end of the project. The data were translated and thematically analyzed.

Results   The findings can be broadly and thematically divided into two categories: "Reducing the knowledge gaps" and "Creation of context for co-creation". The first finding suggests how the preparatory stage was effective in offering useful knowledge for participants to feel comfortable and confident in developing their services. The second finding provides technical and theoretical lessons to PD researchers and practitioners about addressing participation gaps in the preparatory stages of PD.

Conclusions   This study examines how preparatory stages assist in bridging the knowledge gap between participants, resulting from their differing educational and generational backgrounds. We discuss various issues in implementing the preparatory stage and suggest design considerations to reduce participation gaps and to create a context for co-creation in participatory design.

Keywords   Preparatory Stages of Participatory Design, Participation Gaps, Design Before Design, Social Innovation, Integrated Design

1. Introduction

Over the past three decades, the participatory design (PD) community has investigated how democratic processes can be developed and implemented such that stakeholders and designers create and make decisions together (Huybrechts et al., 2017). A central challenge for PD is providing alternative perspectives on participation and democratization; that is, actively exploring alternative ways to organize social environments for innovation that are more democratic, rather than focusing on expert groups and individuals (Björgvinsson et al., 2010). However, this is a complex task, as PD promotes the participation of diverse people and communities. Therefore, designers must develop arenas for participation that allow for participatory processes, even when there are barriers to these activities, such as knowledge and generational gaps between participants.

Participation gaps are formed when people, for different reasons, find it difficult to conduct creative or technical tasks, and feel uncomfortable when asked to participate in design issues (Mitchell & Nørgaard, 2011). These barriers can generate weak identification with the project goals, eventually leading to disengagement (Joshi & Bratteteig 2016). To overcome these barriers, designers collaborate with various interlocutors and interact with participants presenting themselves as both experts and peers (Jégou & Manzini, 2008). By creating spaces to reveal and confront power relations and influence, designers can identify new terms and themes for contestation and new trajectories for action (DiSalvo, 2010). Designers play a role in infrastructuring participatory spaces, creating meaningful encounters by facilitating the development of arenas featuring heterogeneous participants, and legitimizing the marginalized (Björgvinsson et al., 2010).

The preparatory stages of PD involve discussing, criticizing, and evolving design practices (Bentz & Franzato, 2017). These preparatory activities create the right conditions for engagement, enabling researchers to better engage with and relate to participants with respect and sensitivity (Raman & French, 2021). A preparatory stage also includes developing a framework in which people critically discuss and problematize design projects (Kraff, 2020). A wide range of opportunities can be uncovered if designers open their participatory projects to criticism, encouraging participants to critique them (Righi et al., 2018). This study aims to empirically understand how preparatory stages can help bridge the knowledge gaps between participants of PD projects caused by their differing educational and generational backgrounds.

2. Theoretical foundations

2. 1. Participation gaps

Social identities shape opportunities for people, as power is intertwined in the relationships between them and established hierarchies, leading to inequality and marginalization (Tajfel & Turner, 1986). PD is essentially formed by a productive combination of different perspectives of people to understand, create, or change services and products (Steen et al., 2011).

However, gaps such as a digital knowledge imbalance can influence and exacerbate inequality in ways that impact access to and use of technologies, materials/resources, education, and power structures (Blake & Quiros Garzon, 2010). There is growing awareness in the field of PD regarding the importance of engaging people from different ages and socioeconomic backgrounds in design activities to create better digital technologies. However, involving them effectively in co-design remains a challenge (Righi et al., 2018).

Though participation opportunities have expanded, the skills and resources for utilizing these new entryways are unevenly distributed. Participation gaps exist across all types of political actions. Indeed, participation is strongly correlated with educational and social status (Dalton, 2017). Cultural differences may also result in gaps in participatory experiences. The terminology used in these projects is often highly technical and specific, making it difficult to pursue civic engagement efforts in these democratic spaces (Meléndez & Martinez-Cosio, 2018).

The direct involvement of different groups in a design process, although beneficial for the project outcome, requires methods that are sensitive to the specific needs for inclusion (Frauenberger et al., 2011). Thus, it is important to address the knowledge gaps between participants and balance their understanding of the topics and tools used in the process. Moreover, the inclusion of education opportunities for individual participants in the design process and the communication of these opportunities will strengthen their connection to PD values, such as democracy and emancipation (Barendregt et al., 2016). Participation gaps thus remain a relevant topic in PD research and practice. To spread awareness of this subject, designers must continue exploring and documenting methods and frameworks for complex participation, as there is no "one size fits all" solution for these gaps.

2. 2. Preparatory stages of PD

PD processes are a series of activities linked by interpretation, planning, and decision-making. These include workshops or prototyping in which stakeholders work together on the object of design. In contemporary PD, participation is not limited to a single activity, but develops over time, with interactions influenced by context, prior experience, and ongoing learning (Saad-Sulonen et al., 2018). In other words, both the activity and the prior and subsequent experiences in between these activities make a PD project. The temporalities within a PD project are analyzed by closely examining the activities that precede the PD workshops. Preparatory stages of PD can be more than just preparatory, as they are part of the development process (Franzato, 2014). Time-related constructs of participatory activities are relevant to PD research (Saad-Sulonen et al., 2018), as the time and method of implementation of these activities can interfere with the outcomes and experience of the project. Nevertheless, the time before the project (pre-project time) is often not explored in accounts of PD (Saad-Sulonen et al., 2018).

A preparatory stage includes the design that deals with the creation of context, rather than content. It is a mode of integrating systems and setting actions to create environments in which people may cultivate and improve their sense of co-creation (Giaccardi, 2005). This notion of context began to appear in participatory design literature in the 1990s, when

designers began considering and link it to empowerment and effective design (Bjögvinsson et al., 2012). Context is important to a PD project because participation does not arise only during designated design events or through inclusive methods. Rather, it becomes a partially existent aspect of the entire project, from the very first formulations to the point of completion of the design (Andersen et al., 2015).

This study highlights the relevance of context creation in PD projects and the importance of temporal analysis in PD research and practice to understand how preparatory stages are designed and used to reduce participation gaps.

3. Case study

This study considered the case of the Seoul Digital Social Innovation Center, a government-funded project that aims to develop and promote digital social innovation (DSI) among people in Seoul. The Seoul DSI Center encourages citizens to participate in the development of DSIs, that is, finding solutions to a range of social problems using digital technologies (Certomà, 2020) and design thinking as a methodology. The project had a twofold aim: to develop new DSIs and nurture DSI experts. By introducing design-driven DSI to citizens and engaging them in co-creating solutions to social problems, it offers citizens the opportunity to work together and design new technologies to cope with urgent issues in the city.

The project offered citizens the resources required to understand the design and DSI concepts. Citizens, experts, and activists were also given a space for solving the social problems that Seoul residents encounter in their daily lives. Participants were recruited from among willing Seoul residents, regardless of age or educational level. Participants' ages ranged from twenties to sixties, making for an age-diverse group. Their professional backgrounds also varied, including information technology, social innovation, design, and university students studying different majors. This diversity was warmly received as it would be beneficial for comprehending complex social problems and collecting various viewpoints during the co-creation process.

However, diversity also generated participation gaps that require the development of mechanisms to address these gaps. Owing to the COVID-19 government guidelines, the project was conducted online. That is, all meetings were experienced with digital tools such as Miro, Zoom, Google Workspace, etc. In 2021, the Seoul DSI Center was managed by the authors' research team at Yonsei University, Seoul Metropolitan Library, and a social cooperative named Parti. Twenty-nine citizens were divided into five teams, and by the end of the project, these teams developed and tested technology-empowered solutions for various social problems. The project lasted five months, with ten weeks allocated to a preparatory stage focused on training, participant engagement, and co-creation of project rules, schedules, and techniques; this was followed by a participatory design development process.

The preparatory stages included training sessions for the participants, designed to cope with one of the most difficult parts of the project: bridging the knowledge gap between participants. Developed by the authors' research team, the preparatory stage followed a design process, which made it important for all participants to have basic knowledge about design thinking as well as DSI. However, because the participants were diverse in terms of age and social, educational, and cultural backgrounds, the research team used preparatory stages of the project to tackle these unbalanced contexts. Table 1 presents the contents of the lectures and workshops provided in the preparatory stage.

Table 1 DSI PLAY preparatory stage

Date	Content
July 7, 2021	· Basic DSI concepts such as the difference between innovation, social innovation, and digital social innovation · DSI cases that could exemplify how these projects are developed, and the motivation behind them
July 14, 2021	· The design process, more specifically, how to effectively conduct the process of social innovation through design thinking · The difference between innovation and improvement · Design by innovation, and innovation by design
July 21, 2021	· An in−depth view of design mechanisms such as Double Diamond, design research methods, service design facilitation, ethnographic interviews, and team building
July 28, 2021	· Survey techniques in a workshop made to practice the methods for defining the target users of a project
August 11, 2021	· Participatory Design
August 18, 2021	· United Nations Sustainable Development Goals · Social problem−solving projects
August 25, 2021	· Digital literacy, and the competence to independently engage in information research, management.
September 1, 2021	· Minimum Viable Product (MVP) · Canvas for value proposition
September 8, 2021	· DSI results · Process of spreading social innovation and impact investment.
September 11, 2021	· Minimum Viable Product (MVP) design and testing. · Prototyping

Considering the limited timeframe and COVID-19 restrictions, the training sessions aimed to provide participants with the basic knowledge needed for conceptualization and development of DSI. Because the development phase follows the design process, these concepts and tools were given to the participants in advance, considering most participants do not come from a design background. Social innovation was the focus of the project, and it was essential that all participants had level knowledge about what was and was not social innovation before starting their team activities.

These training sessions were also developed considering different people from varied backgrounds would have different forms of learning topics with this level of complexity. With time and patience, participants learned new concepts through lectures and exercises where participants practiced and discussed the lectures after being divided into smaller teams. Additionally, explanations were provided on conducting research and surveys and prototyping, considering that some participants had never experienced these processes.

4. Methods

The preparatory stage was evaluated through surveys, interviews, and observation. Surveys were used to collect participants' perception of how the preparatory stage was conducted. Interviews aimed to understand if and how knowledge gaps were addressed in the preparatory stage. The observation was conducted by the first author to experience the overall process of preparatory stage and the DSI projects from a participant perspective.

We conducted surveys from July to September 2021 after each lecture during the training session. Participation in the surveys was voluntary and anonymous, and the number of participants in each lecture varied. Over ten weeks, we collected 85 responses. The questionnaire comprised four questions on the difficulty of the lectures, participants' satisfaction with the training, and suggestions to improve the program.

The interviews were conducted from February to March 2021 after the entire process was completed. We recruited five interviewees among the participants who commented on the effects of the preparatory stage on their understanding and practicing DSI. In line with the rest of the participants, these five respondents were also diverse in terms of age, profession, and educational background (Table 2). The interviews were conducted online and aimed to understand how their knowledge about the topics of the lectures changed before and after the preparatory stage and how the preparatory stage influenced their project experience.

Each interview was semi-structured and consisted of five questions on how much knowledge participants had about social innovation, design thinking and processes, startups, social ventures, and app development prior to the DSI training program; what knowledge or skills they thought were needed to develop a DSI project and if the lectures provided participants with sufficient knowledge to develop the DSI solution; whether the classes helped level participants' knowledge; the prominent concepts learned in the lectures; and whether participation in the lectures made them more confident in the project phase. Each participant was provided with a list of lecture titles and a summary of the contents before the interviews.

Table 2 Interview participants information

Participant	Age	Educational/Professional background
P1	35	Central Asian Languages
P2	20	Computer Science, Undergraduate Student
P3	28	Child and Family Studies Graduate Student
P4	38	Archivist
P5	61	Small Business / Public Market Consultant

The observations were made by the first author, who observed the entire process of the preparatory stage (ten weeks) and DSI projects (ten weeks) as a participant. Throughout the observation, the author was careful to maintain a balance between being an insider and an outsider and between participation and observation (Baker, 2006). This was useful for capturing the data on team dynamics and communication contexts that supplemented and cross-checked the attitudinal data obtained from surveys and interviews (Jamshed, 2014).

For data analysis, we used thematic analysis to understand experiences, thoughts, or behaviors across a dataset. We wanted to understand how participants experienced and judged different aspects of the lectures (Kiger & Varpio, 2020). The interview scripts and survey answers were documented in Korean and later translated verbatim into English by the research team, which consisted of members with English and Korean proficiency. The transcription amounted to 1290 words. To explore and develop an understanding of the patterned responses from the participants, themes were identified from the meaning-based patterns extracted from the raw data.

5. Results

During the thematic analysis, we organized the empirical data into the following themes: "reducing the knowledge gaps" and "creating a context for co-creation."

5. 1. Reducing the knowledge gaps

In this theme, data were classified according to participants' perception of how new the topics were to them, to what extent the lectures delivered sufficient knowledge to start a DSI project, and how the lectures were sufficient in leveling knowledge of the students in general. During the interviews, we confirmed that the participants had varied level of knowledge about the project topics prior to the training: social innovation, design thinking and process, social ventures, and app development. "Yes, I was familiar with most of the theoretical content. However, some lectures prepared by the instructors were new to me. It was my first time learning about app development" (P1); "Before the DSI program, I was interested in social innovation and developing apps, but I never thought these two concepts could be integrated. I do not have enough professional knowledge about IT startups or social ventures but did attend some lectures by hackers and startup founders before" (P2); "I heard about social innovation and design thinking for the first time in a social design class before, so the terms were not unfamiliar; however, I was not used to them. That is why I did not fully understand these concepts before the DSI class" (P3); "I did not know much about it" (P4); and "I never had proper education on these topics" (P5).

The participants were overall satisfied with the knowledge they gained from lectures. "I think the knowledge and information provided was sufficient. However, the non-face-to-face classes due to COVID-19 made it more difficult to learn" (P1) "The knowledge provided was good" (P2); "I have been provided sufficient knowledge in the development of the DSI project. ... [I]t would be better if I could learn more about conversation skills, such as understanding and respecting each other, or setting possible rules (facilitation techniques)" (P3); "The lectures were sufficient for me because I didn't know much about it before" (P4); and "Before the project, I did not know much about social innovation and social impact. I learned this through lectures. I think this is the most important aspect to learn before developing a social venture app" (P5).

The participants commented that the lectures were sometimes difficult but comprehensible and useful for gaining new knowledge, which suggests that the preparatory stage was effective in reducing the knowledge gaps. "Sometimes the classes were hard, but after each class, we could practice, so if I did not understand in the lecture, I received help from my teammates" (P1); "Yes, the topics were difficult, but teachers started with basic concepts" (P2); "Yes, because even if one participant did not understand the content, after the lecture, there was time to practice together; also, there was a feeling of everyone working for the same goal" (P3); "Yes, even though in some classes students might have had difficulty in their learning process" (P4); and "I cannot say for other people, but it helped me understand what we were about to develop and what was the expected result, as well as the methods of research and development" (P5).

However, some participants needed more time to apply the knowledge to a DSI project, suggesting that the knowledge gap may have remained especially in developing DSI. "I wish we had more time to practice before app development" (P2); "There was insufficient time to practice the necessary skills before implementing the project. Before the start of DSI development, participants needed time to apply their knowledge" (P3).

Researchers found that teamwork dynamics played a crucial role in solving participants' knowledge gaps. As team activities had the clear purpose of serving as practice rooms, participants were able to share their thoughts, questions, and previous experiences more freely. For example, as predicted by the researchers, older participants found it difficult to understand lectures about research methodology using digital tools such as Miro, Google Forms, or Google Docs. To overcome such problems, the teams were divided to be diverse in terms of age, profession, and educational background. Participants had to resolve a given task based on the lecture they had listened to. While performing this task in a smaller group, those experiencing difficulty in understanding the topics could ask questions to their peers and solve a problem given in a specific setting. We found this dynamic to be effective in improving the participants' learning experience.

To conclude, the participants had varying levels of knowledge of the topics discussed in the lectures prior to the project, highlighting the importance of reducing the gap. They found the lecture topics useful for developing their DSI and that, overall, the training was effective in enhancing the skills of participants with less knowledge about the topics addressed. The findings also demonstrate the importance of team activities when addressing these gaps.

5. 2. Creation of context for co-creation

In this theme, the data were classified according to participants' preference on the lecture contents and activities, the contribution of the lectures to their final solutions, and the negative and positive aspects of the process.

Participants' opinions on their favorite lectures informed us about the suitable approaches that should be implemented when developing preparatory stages for DSI projects. These findings are important features of the co-creation context development because the goal of the preparatory stage was to build a space in which participants could feel engaged and

interested. The participants listed the following as their favorite lectures "Research methods, and MVP development (were my favorite)." (P2); "[T]he facilitation techniques were the most interesting. I learned a lot, and even though I could not apply it all, it helped me listen to other people's opinions when conducting meetings in my daily life" (P3); "Facilitation techniques" (P4); "I liked the lecture on conducting surveys and interviews" (P5).

One of the most positive aspects of the preparatory stage was the rich empirical knowledge about DSI provided by the case studies. The introduction to these case studies and the sociotechnical contexts that emerged helped participants understand how a DSI project is conceived, what the project outcome is, and how it operates. For example, in the survey, participants stated: "I think I understood the concretization of digital social innovation to some extent through the cases," "I understood better since I was given specific examples," "I think it was an opportunity to learn about some of the tasks that the local government is doing," and "I think I got a better sense when there were examples of the apps for buying face masks during COVID-19!"

The participants had varied feedbacks on the contribution of the lectures to their final solutions. Some were content with the overall process and outcomes of the project. "The design thinking five-step process (empathy-definition-idea-prototype-test) was well implemented" (P3); "I think they gave us insights on how to start the process of making the project" (P4); and "I was proud of our result! The research and the plan to make the app profitable was designed based on things we learned in the lecture" (P5). Others pointed out the time allocated to practice and apply the knowledge as a major difficulty. "I spent a lot of time learning design thinking methodology, but I was very disappointed that I could not use it when I was working on the team project" (P1); and "If the lectures were presented during the development of the app, I think we would be able to practice what we were learning" (P2)

Despite these critical points, participants appreciated the opportunity to work and practice together during the training. "My favorite part was working together," "It was nice to have a small team and practice what we learned. It was also good for the instructor to move between teams and give feedback," "(We need more) time to collaborate with each other". These views are consistent with the author's observation on how participants were dissatisfied with the time allocated for these teamwork activities, especially because this was when people could interact more, showcase their abilities and ideas, and assimilate what was being thought.

The empirical data provide a detailed understanding of how the lectures were perceived by the participants, thereby revealing what practices to follow or avoid when designing preparatory stages to train participants before complex participatory dynamics. The strengths of the classes as a preparatory stage included case studies that reflect participants' realities, a respectful environment with communication between participants and researchers, participants' ability to develop the rules of the project together, and their active participation in how the process was being conducted. Meanwhile, time constraints were considered as a weakness of the process. In terms of content, the participants found it useful to learn about the design process, research methods, and in-depth conceptualizations of the project themes. Above all, they appreciated setting the ground rules for the project and

learning facilitation techniques. These aspects elucidate how different factors of the training program allowed participants to cultivate creative conversations and experience a project context based on their realities.

6. Discussion

The findings from the thematic analysis demonstrates the effectiveness of the lectures in bridging the existing gaps and provides insights into the best practices for developing preparatory stages for PD. Participants' likes and dislikes during the preparatory stage inform the creation of a context for co-creation, as this relates to environments in which people may take control of the setting of their production (Giaccardi, 2005). To follow this empowerment endeavor, it is crucial to understand participants' multiple perspectives within a project. Based on our empirical findings, we discuss (1) if and how preparatory stages can assist in bridging the knowledge gaps in the PD process and (2) how designers developing their PD processes can improve their preparatory stages.

One of the biggest challenges researchers faced in implementing DSI projects was reducing participants' knowledge gaps caused by the diversity between participants' backgrounds. The interviewees in their 40s and 50s had business or software backgrounds, whereas those in their 20s had design, psychology, and computer science backgrounds. Diversity helps projects benefit from different perspectives. However, this can also create disparities between the participants. Accordingly, the training process was designed to teach DSI-related topics and, through design methodology and DSI examples worldwide, it showed that the development of such project could be democratic and benefit from everyone's input regardless of their educational and professional background. P3's statement "there was a feeling of everyone working for the same goal" succinctly describes the achievement of our preparatory stage. The interviews, surveys, and observations demonstrated the importance of the preparatory stage in getting people prepared for the development stage of the project. The knowledge gained made participants feel more confident and prepared for their development stage.

The preparatory stage also had weaknesses that compromised its effect in bridging knowledge gaps. The participation gaps cannot be addressed in the preparatory stage by only considering the content of each lecture; how participants will experience and apply the lessons learned in their development experience also need to be considered. It is important for participants to have sufficient time for practicals even before the development phase. It is possible to bridge this gap only if people are given the opportunity to practice what is learned before development.

In summary, the preparatory stage developed as a training session can bridge knowledge gaps caused by educational and generational disparities between participants (1) when it covers diverse aspects of design project development, such as the methods, tools, and concepts; when the content of these lectures reflects participants' realities, approximating them with the topics to be addressed and unveiling similarities between them; (2) when the

teamwork during these lectures is given necessary importance as main parts of the lectures; and (3) when participants' opinions about their own project are listened to and addressed in real-time. Based on our findings, we propose the following considerations for designing preparatory stages.

First, case studies allow participants to not only better understand what to expect from a project, but also to identify important parts that are missing in their own projects (Bandura, 1994). In our study, the participants found it especially useful to learn about DSI cases in Korea, since these cases demonstrated the potential of DSI in their own context and provided them with confidence and knowledge from experiences. These case studies are also a great way of introducing topics relevant to the participants' own context for co-creation.

Second, co-creating ground rules and acquiring facilitation techniques allow PD participants to be more confident in the process they are about to start. Due to the fact that they enable participants to move from passive to active roles. This experience also allows hierarchical roles, such as team leaders, team presenters, or rule makers, to be defined by all stakeholders together. Discussing how important it is to learn and apply respectful communication to their own processes positively affects collaboration throughout projects.

The third is to pursue an open-ended participatory design, a setting where participants can discuss and explore how they wish to engage in the project's day-to-day activities (Björgvinsson, 2008). Developing an overall project framework as an open-ended participatory design allows participants to feel listened to and empowered and helps designers create an attitude that accepts all stakeholders as creative people (Mattelmäki, 2005). In our study, problems, such as time allocation and management of online tools, were identified and solved in the process because we listened to our participants through the surveys. These considerations can help designers create participatory experiences that offer the necessary knowledge and skills to co-create in a respectful environment and develop a project context in which people cultivate and improve their sense of co-creation. In other words, preparatory stages become more likely to succeed and meaningful when they allow participants to acquire knowledge to bridge gaps and offer an environment in which they are inspired and motivated to co-create.

One limitation of this study is that these considerations were derived in the context of designing DSI in Seoul. Future work should design and validate the preparatory stages in other contexts.

7. Conclusion

This study explored the potential of the preparatory stage in reducing participants' knowledge gaps in PD practices using a case study. We designed a training program at the preparatory stage and examined its effects using surveys, interviews, and observations. Empirical data suggest that the preparatory stage is effective in offering knowledge useful for participants

to be ready and confident in developing their projects. Based on our findings, we propose considerations for developing preparatory stages for PD, aimed at reducing participation gaps.

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