Facilitating Dialogue Through Generative AI in Urban Planning Workshops

An Evaluation of a Participatory Tool Integrating Physical Prompts and Visual Output

Master Thesis

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Abstract
Communication barriers and differences in expertise between citizens and professionals often hinder meaningful citizen participation in urban planning. This study introduces CAPE AI, a participatory tool designed to support inclusive dialogue by integrating physical MethodKit cards with AI-generated visualisations in early-stage urban planning workshops. We created a co-creative workshop structure inspired by the Future Workshop method to support the use of the tool. Together, the tool and workshop format were evaluated through a pilot test with students experienced in participatory design and a focus group with architects from C.F. Møller. Findings show that the hybrid format fostered collective ideation and supported collaborative group dynamics. The AI-generated images effectively surfaced tacit ideas and sparked dialogue; their ambiguity encouraged reinterpretation and the co-construction of shared narratives rather than fixed outcomes. These results suggest that CAPE AI can support participatory processes aligned with the placation and partnership levels of Arnstein's Ladder. Further research involving citizens is needed to assess its effectiveness in real-world planning contexts.

Keywords: participatory design, architecture, urban planning, image generation, artificial intelligence, participatory tool, citizen participation, co-creative workshops, visual communication, AI-supported dialogue.

1. Introduction

Urban planning fundamentally shapes how people experience and interact with their environment [2, 12, 29]. It is therefore important to involve citizens early in the planning process to ensure that the proposed design aligns with public needs [12]. Furthermore, incorporating citizen participation in urban planning improves the satisfaction of the built environment by ensuring that projects align with community needs [17]. Traditional Participatory Design (PD) methods, such as future workshops [25], collaborative prototyping [6], and cartographic mapping [23], have been utilised to enhance inclusivity and engagement [6, 14, 23]. Although these methods help amplify diverse voices, facilitate mutual learning, and support idea generation [5], communication constraints and differences in expertise between citizens and professionals still pose challenges to achieving meaningful participation [5, 17].

When applying participatory methods, it is important to recognise that not all participation grants the same degree of influence. In her 1969 framework, Arnstein introduced the Ladder of Citizen Participation to illustrate the varying levels of citizen power in decision-making processes [1]. The ladder ranges from manipulation to citizen control, distinguishing between nonparticipation, tokenism, and genuine citizen power. Arnstein argues that participation should extend beyond symbolic gestures and instead empower citizens to make meaningful contributions to decisions that affect them. The ladder has become a foundational reference in PD and planning discourse [5, 17], raising ongoing questions about how participatory methods can empower citizens in practice.

According to the study by Wilson and Tewdry-Jones, traditional engagement methods struggle to communicate aspirations for urban change on citizens' terms [29], raising questions about how these methods can be adapted to ensure that participants feel heard in the process. Drawing from earlier work [7, 9, 13, 20, 18, 27], it is essential to create meaningful engagement for citizens while establishing a shared language with architects. Digital participation extends these traditional methods and tools into the digital realm by leveraging technologies to engage

people and communities in discussions, collaboration, and decision-making [27, 28]. Recently, the exploration of Artificial Intelligence (AI) in PD has gained increasing attention, highlighting its potential to enhance decision-making and democratise design processes [15, 18]. This shift aligns with broader discussions in PD, where meaningful engagement and shared understanding between citizens and architects are key considerations.

Despite efforts to foster meaningful engagement, PD still faces challenges in ensuring that citizens feel genuinely heard and that their input has an influence on decision-making. Alongside, there is a growing interest in integrating technology into PD practices to ensure participants feel heard and to minimise the expertise gap [29, 30]. This study investigates how generative AI might play a mediating role in citizen engagement workshops, particularly in facilitating communication and idea development. Building on prior work in PD and AI-supported design, we focus on whether AI-generated visualisation can contribute to more inclusive forms of participation. This led to the research question:

How can generative AI-supported visualisation during urban planning workshops facilitate meaningful citizen participation, going beyond nonparticipation and the lower levels of tokenism?

Guided by our research question, we examined the intersection of PD, urban planning, and AI by studying existing approaches and identifying opportunities for further exploration. We observed a citizen-oriented planning workshop and interviewed architects at C.F. Møller about citizen inclusion. Drawing on these insights, we developed a Google Colab prototype that uses MethodKit cards to generate AI-supported visuals for ideation, along with a supporting workshop structure. After piloting the tool with students from an academic background in PD and refining it, we evaluated it through a focus group with C.F. Møller architects. Thematic analysis revealed that combining physical cards with real-time AI imagery prompted reflection, surfaced tacit ideas, and supported collaborative interpretation. These results suggest that CAPE AI can foster more meaningful participation, aligning with the placation and partnership levels on Arnstein's Ladder.

The main contributions of this paper are threefold. First, the development of CAPE AI, a prototype that integrates AI-generated imagery into a participatory workshop format, enabling participants to engage with visual content derived from physical inspiration cards. Second, the design of a co-creative workshop structure that combines physical and digital materials to scaffold participation in early-stage urban planning. Third, an expert-based evaluation that offers insights into how generative AI may support inclusive dialogue and citizen participation in design processes.

2. Related Work

This section examines existing research connecting urban planning with PD and AI to analyse their roles in citizen engagement, ideation process, decision-making, and stakeholder communication [7, 10, 15, 19]. By assessing prior studies, this review highlights emerging trends, challenges, and gaps in the integration of AI-driven tools into participatory urban design, particularly in citizen engagement [11, 15, 18].

2.1 Arnstein's Ladder of Citizen Participation

Sherry R. Arnstein's 1969 framework, A Ladder of Citizen Participation [1], expanded on the challenges of public involvement by examining three federal social programs: Antipoverty, Urban Renewal, and Model Cities. Arnstein developed an eight-rung ladder to illustrate the varying degrees of citizen influence in decision-making processes. The rungs span from manipulation, where participation is merely symbolic, to citizen control, where citizens possess substantial decision-making power. Beyond listing levels, Arnstein grouped the ladder into three broader categories: degrees of citizen power, degrees of tokenism, and nonparticipation, to emphasise the spectrum of participation further. Arnstein acknowledges that the typology simplifies reality, overlooks diversity among citizens and powerholders, and that participation rarely fits neatly into eight levels. Its impact, she stresses, depends on how it is used and by whom.

This framework remains a critical tool for assessing the depth and authenticity of participatory efforts. A visual representation of the full ladder is provided in Figure 1.

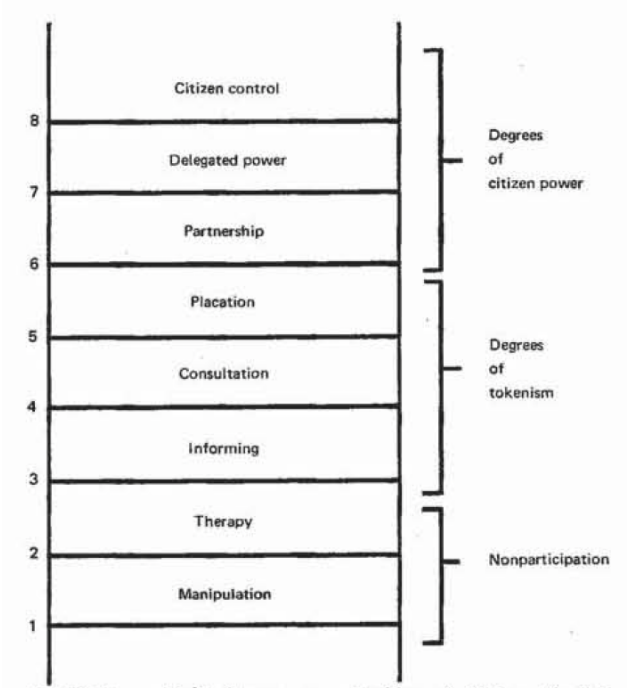


Fig. 1. Arnstein's eight rung ladder [1].

2.2 Tangible Artefacts in Participatory Urban Planning

PD in urban planning aims to integrate citizens into decision-making processes, shifting from expert-driven models to collaborative approaches that empower affected communities and promote inclusion, transparency and stakeholder participation [1, 10, 13]. Artefacts are integral to engaging citizens in participatory urban planning processes, as they translate abstract planning concepts into tangible representations and mediate discussions between stakeholders [13, 21, 24].

Several studies illustrate how different participatory methods and artefacts shape citizen engagement in urban planning [7, 9, 10, 13, 20, 21, 24]. Research on participatory urban development methods highlights the role of material artefacts in structuring discussions [13], digital tools in mediating communication and improving collaboration [20, 21, 24], and playful approaches to foster inclusive participation [7, 9]. Hansen and Dalsgaard [13] explored how utilising physical artefacts can facilitate participatory discussions in urban planning workshops. By introducing fictional library visitors as tangible markers on a blueprint, their study demonstrated how physical representations enhance accessibility for non-experts engaging in spatial decision-making. This highlights the role of artefacts in structuring dialogue and fostering inclusivity in participatory processes. Similarly, other studies have examined how tangible and interactive tools can facilitate participatory engagement [21, 7, 9]. For instance, Maquil et al. [21] utilised a tangible user interface (TUI) to support collaborative urban design, demonstrating how interactive physical models mediate digital and physical interactions, allowing participants to manipulate spatial elements. Their findings highlight how TUIs enhance collaboration and decision-making by making urban design discussions more interactive and visually accessible.

2.3 Artificial Intelligence in Participatory Design

In recent years, new technologies have been integrated into existing participatory techniques to explore how they can help reduce barriers to participation [29]. Among these advancements, AI has gained increasing attention, with research exploring its potential in PD, co-design, and idea generation processes [8, 18]. Studies highlight how AI tools, such as Dream Studio and Midjourney, have been integrated into co-design workshops, allowing participants to generate and evaluate multiple design variations in real-time [8, 18].

Several studies illustrate how AI-generated visualisations shape communication and streamline the ideation process across different architectural contexts [11, 27]. Gonzalez et al. [11] demonstrated how AI-generated imagery can translate verbal input into visual representations, enabling citizens to articulate their preferences and engage more meaningfully in urban planning discussions. Similarly, Wang et al. [27] investigated RoomDreaming, an AI-assisted interior design tool that generates rapid design alternatives based on user input, showing how such tools can support ideation and collaboration between experts and non-experts.

Beyond visualisation and ideation, AI-generated tools also play a role in decision-making within design processes. Joshi et al. [15] explored how generative AI impacts decision-making, revealing that AI-generated proposals can both expand creativity through unexpected suggestions and constrain it by reinforcing existing patterns, highlighting the dual impact of such tools on design diversity.

Our study builds on prior research by integrating a physical artefact used in PD with AI. While existing studies have focused on AI-generated visualisations as polished or finalised design outcomes, we explore AI as an interactive tool for early-stage ideation. By using MethodKit cards as prompts, participants will generate AI-assisted visualisations, allowing them to refine and expand their ideas through an iterative workflow. To enable this process, we developed a workshop structure designed to support participants in engaging meaningfully with the AI tool.

3. Method

To explore how an AI-based tool could support citizen engagement in urban planning workshops, we developed and evaluated a prototype through two stages: a pilot test with students experienced in PD and a focus group with architects from C.F. Møller. Expert interviews and observational data informed the design of the tool and the accompanying workshop structure.

3.1 C.F. Møller Workshop Observation and Architect Interviews

To support our understanding of real-world participatory practices and inform the design of our prototype described in Section 4, we observed a citizen-oriented urban planning workshop and conducted semi-structured interviews with architects from C.F. Møller.

The interviews were held online and lasted approximately 45 minutes each. We spoke with two architects experienced in participatory urban design, focusing on their approaches to citizen engagement, the communication of complex ideas, and the tools they use in workshops. Their reflections helped clarify practical challenges and contributed to shaping both the functionality of the prototype and the surrounding workshop structure.

In addition to the interviews, we observed a workshop organised by C.F. Møller in collaboration with The Sports Association Aarhus, which involved citizens from local sports clubs. The goal of the workshop was to gather input on user journeys to use in the development of a sports facility in the city, and it lasted approximately two hours. During the workshop, participants worked in five groups, each consisting of four to five people. We observed the session as non-participants, focusing on facilitation techniques, the use of support tools, the balance between individual and group activities, and participants' engagement with the different materials. Throughout the session, open-ended notes and pictures were taken for internal reference to capture relevant behaviours, interactions, and tools.

3.2 Pilot Test

To test our prototype and determine whether our expectations for the workshop were met, we conducted a pilot test. Specifically, whether the timings in the process worked as intended and observe how users would interact with the inspiration cards, other participants, and the tool. This allowed us to assess if the workshop flow supported meaningful participation and that the tool was intuitive to use.

The pilot test included six participants, all of whom were students from Aalborg University with academic backgrounds in PD. While not representative of the general public or architects, their expertise made them well-suited to provide informed feedback on the participatory aspects of the workshop and tool. Participants were selected through convenience sampling based on availability and relevance. The pilot test followed the planned workshop structure, which included an introduction, individual and group interactions with the cards, and ideation using the AI tool. As in a real workshop, participants were guided through each step. The final presentation phase was omitted, as the six participants formed only one group. The two-hour session concluded with a semi-structured group interview.

3.3 Focus Group on the AI Tool and its Workshop Structure with Architects from C.F. Møller

To explore the potential of the AI tool for early-stage ideation in urban planning, we conducted a focus group with architects from C.F. Møller. As there were no upcoming projects at the firm that included workshops at this stage of the planning process, it was not possible to evaluate the prototype in a real-world setting with citizens. The focus group, therefore, served as an alternative means of testing both the workshop format and the tool. The aim was to gather expert feedback on the perceived usefulness of the tool and the overall structure of the workshop. To achieve this, the architects participated in the workshop, adopting the role of citizens, which allowed them to experience the tool from a non-expert perspective.

The focus group included eight architects from C.F. Møller, all of whom have experience facilitating architectural workshops. It lasted 1.5 hours and began with an introduction to the tool, the surrounding workshop structure, and the overall purpose of the prototype. Participants then completed the workshop activities, following the format described in Section 4.3. The focus group concluded with a semi-structured group interview, which was audio-recorded and transcribed. Insights from this evaluation are presented and analysed in Section 5.

3.4 Data Collection and Analysis

Data was collected during the pilot test and focus group through audio recordings and observational note-taking. The notes captured participants' verbal responses, interactions with the cards and the AI tool, as well as non-verbal cues such as group dynamics and reactions to the generated images. These notes were used to supplement the transcribed recordings during analysis, providing contextual insight. Additionally, AI-generated visualisations that participants found useful or referred to in discussions were saved to support interpretation.

The data was analysed utilising thematic analysis, following the six-phase framework outlined by Kiger and Varpio [16]. This process involves: familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. The focus group data, presented in Section 5.2, was analysed systematically, drawing on transcribed recordings and researcher notes. Themes were developed through iterative analysis to ensure a grounded interpretation of participants' experiences. In contrast, data from the pilot test were analysed informally through reflective interpretation of interview responses and participant behaviour during the session.

4. The Design of CAPE AI

As part of our contribution, we have developed a digital tool called CAPE AI (Citizen–Architect Participatory Expression through AI), along with a corresponding workshop structure designed to support its use in participatory urban planning settings. These will be evaluated in an expert focus group with architects from C.F. Møller, as described in Section 3.3, to gain insights into how generative AI may support inclusive dialogue and citizen participation in design processes.

The primary goal of CAPE AI is to support citizen participation in urban planning workshops by providing a means to express ideas visually. It was developed to help create a shared understanding using AI-generated images as a visual language. Drawing on Arnstein's ladder of citizen participation [1], the tool aims to move beyond the lower levels of tokenism by giving citizens a more active role in the planning process.

4.1 Insights on Workshop Flow and Image Use from C.F. Møller

The workshop and interviews with C.F. Møller provided valuable insight into their current participatory practices. One notable insight concerned how they often structure workshops to begin with individual tasks, such as using inspiration cards, followed by brief group presentations and then collaborative work. Usually, such sessions conclude with a plenary round where each group presents one finding to the rest of the participants. This understanding informed the structure of our workshop, particularly the inclusion of individual reflection to encourage engagement. In the interviews, visual and tactile tools were described as helpful in the early stages of ideation, particularly when working with clients or non-designers. While visual materials can help involve citizens, the architects noted that overly technical or architectural imagery may exclude non-experts. This informed the decision to keep the AI-generated imagery more abstract and open-ended, making it easier for citizens to interpret and build upon during the workshop.

4.2 Design Principles and Participatory Foundations

CAPE AI's workshop is grounded in PD principles, with a focus on mutual learning, co-creation, and user empowerment. Rather than positioning users as passive informants, PD fosters spaces for dialogue where power and knowledge are redistributed among participants [22]. This approach enables participants to take an active role in generating ideas and shaping outcomes, which is particularly important when working with citizens in urban planning.

Fig. 2. Two cards from the MethodKit Neighbourhoods card deck. The top card: Events & Culture. The bottom card: Local Business

Building on these principles, CAPE AI is implemented as a digital tool that merges the tactile interaction of physical cards with AI-powered image generation. Drawing on findings by Hansen and Dalsgaard [14], the integration of tangible artefacts supports accessibility and fosters inclusive, participatory dialogue. The chosen MethodKit card deck for CAPE AI is Neighbourhoods, as it contains urban themes and concepts, see Figure 2 for examples. Rather than directing the process, the cards are intended to inspire participants, spark ideas and reflection, and serve as a shared reference point for group discussions. Our use of MethodKit cards is supported by Bornoe et al. [4], who found that such cards help structure discussions, support idea generation, and enable non-experts to engage in creative decision-making, aligning closely with our workshop structure.

The physical cards serve as prompts for CAPE AI and are integrated by photographing them through the camera interface, which generates visual interpretations based on their content. To facilitate this process, the user interface is structured to support a simple and intuitive workflow (see **??** for an overview of the interface). On the left, the input area consists of a live camera feed displayed within a square frame, accompanied by two buttons: 'Clear', which deletes the captured image, and 'Submit', which initiates the generation process based on the captured image. Once uploaded, CAPE AI uses optical character recognition (OCR) to detect and interpret the text on the cards, which is then mapped to corresponding image generation prompts in a local database. Stable Diffusion processes this input to generate visual interpretations based on the recognised keywords. The output area includes a placeholder frame that displays a loading icon during generation and the final AI image once complete. This setup establishes a visual connection between input and output, supporting intuitive understanding of the transformation process.

The integration of AI-generated imagery aims to help surface ideas that may otherwise remain tacit or difficult to articulate, particularly for individuals without a design background. The visual outputs produced by the AI are intended to prompt discussion rather than present final proposals, allowing their meaning and narrative to develop through dialogue.

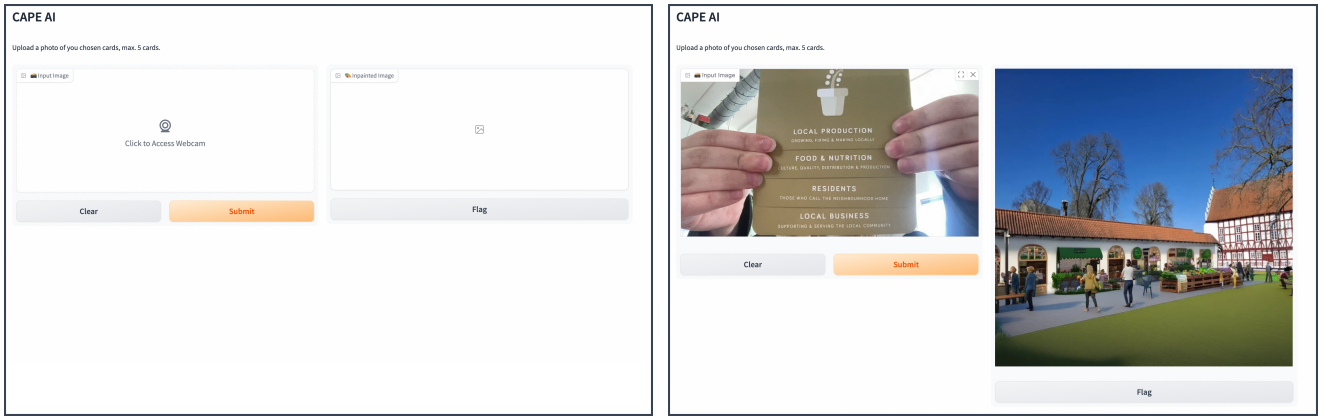
4.3 CAPE AI's Workshop Structure and Tool Use

To explore the use and potential of CAPE AI in a participatory setting, we designed a dedicated workshop structure that integrates the tool into a co-creative process, see Figure 4. In creating the workshop structure, we have drawn inspiration from the Future Workshop method [26].

The workshop was structured in four phases: an introduction to the tools and purpose, individual and group work with the MethodKit cards, collaborative image generation using CAPE AI, and final group presentations. Each phase was designed to facilitate participation and idea sharing, forming a framework for integrating CAPE AI into a co-creative process. The whole workshop structure is described in more detail in Appendix A.

Phase 1

The workshop begins with a brief introduction to its purpose, CAPE AI, and the workshop's structure. The space and reference picture are presented, and expectations for collaboration are set.



(a) Before any input from participants

(b) After input and generation

Fig. 3. Interface of CAPE AI's two states

Phase 2

Each participant begins by reflecting individually on four pre-selected MethodKit cards and selects the ones that interest them. They then present these to the group. Afterwards, the remaining cards are made available for group exploration. Participants may choose additional cards from this pool, but their total selection must not exceed four cards, including the previously chosen ones. Any newly selected cards are also briefly presented to the group.

Phase 3

In this phase, each group explore the pool of cards selected during the previous phase and may combine up to five of them to generate an image with CAPE AI. Cards are scanned using a camera; the tool processes them and displays the result. While waiting, groups discuss their expectations and then reflect on the image that has been generated. The process is iterative, as groups can explore different card combinations and ideas before selecting one final image to present.

Phase 4

In the final phase, the groups present their selected image and reflect on their ideas in plenary.

4.4 Trade-offs and Tool Constraints

Some limitations were anticipated and accepted from the beginning of the project, while others were identified through pilot testing. Section 3.2 describes a pilot test of CAPE AI and its workshop format.

Early in the development process, several limitations were identified and deliberately accepted. One example is the generation time of approximately 40 seconds, which was considered a reasonable balance between speed and output quality. Reducing the generation time further would have required fewer inference steps, resulting in a notable decrease in image quality, a trade-off considered less desirable for the intended use of the tool [3]. While 40 seconds might have felt long in a group setting, it offered a valuable pause during which participants could share their expectations and discuss the anticipated output before it was revealed. This approach was explored during the pilot test and subsequently integrated into the final workshop format to maintain engagement. The pilot test also showed a mismatch between participant expectations and the generated outputs. Some participants anticipated more realistic or detailed images and were surprised by the abstract nature of the results. To mitigate this, the final workshop design included example outputs introduced before the generation task, as described in Appendix A, helping to align expectations and clarify how the tool was intended to support discussion.

We chose to limit citizens' input options by using MethodKit cards without allowing customisation. This decision enabled the creation of predefined prompts linked to each card, providing a degree of structure to guide participants as they reimagined an urban area. While allowing full customisation might have encouraged broader idea generation, we found in the pilot test that a constrained set of options helped focus discussions and ensured a more consistent framing across participants. Another limitation of the tool was the restriction to a single

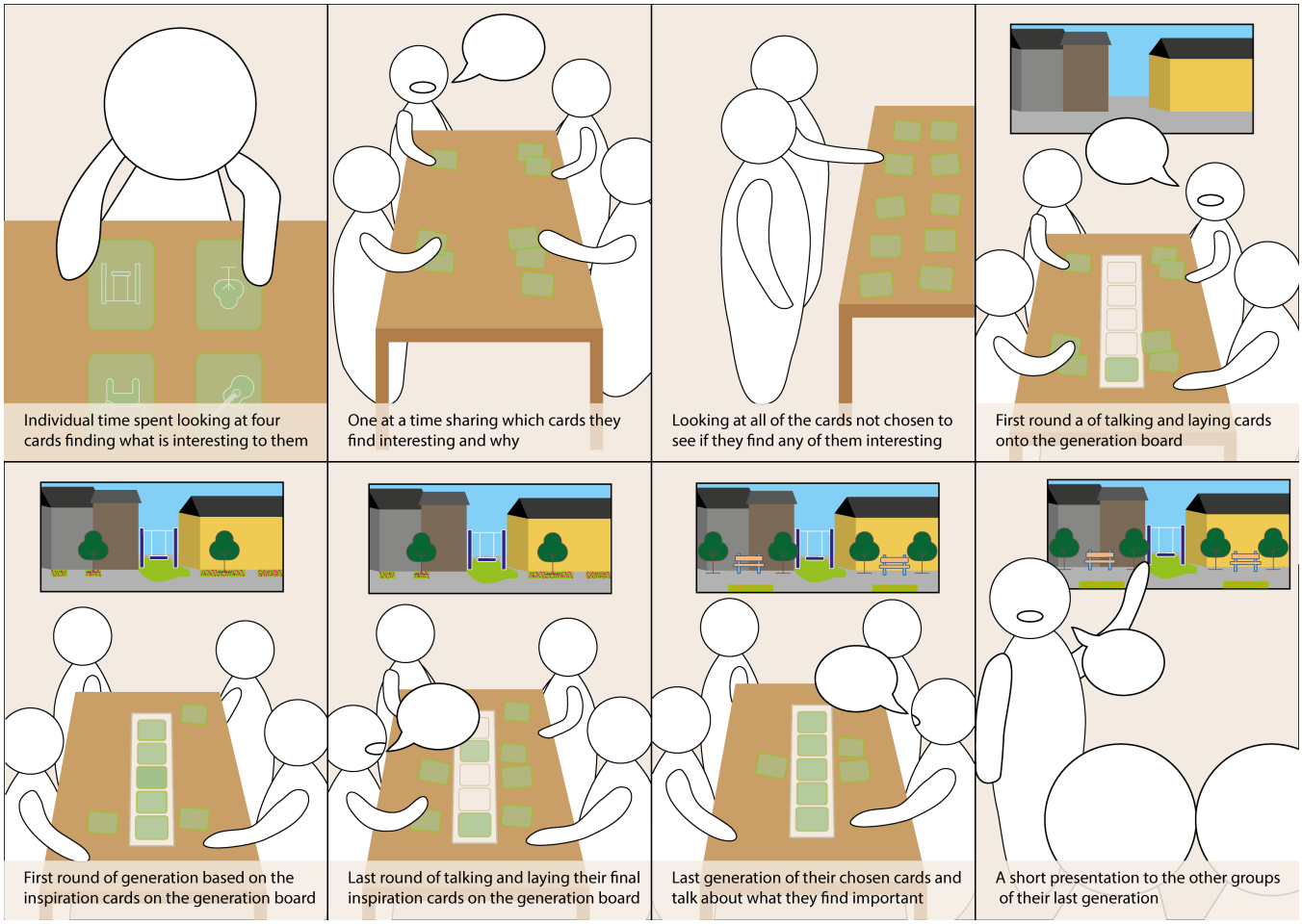


Fig. 4. A storyboard of the workshop structure.

generated outcome per round. This decision followed tests with four, three, and two outputs per round, which consistently resulted in runtime errors due to memory constraints, requiring a complete restart of the runtime environment. Although multiple generations could have provided additional discussion points during workshops, the instability caused by memory overload made this approach unfeasible. Even when testing with increased GPU capacity, the error persisted after just two to three rounds of generation.

These trade-off decisions were made intentionally to stay within the project's scope while balancing stability, customisation, speed, and output quality. Although certain features were deprioritised, such as custom user input and multiple image generations, they represent relevant areas for future exploration as technical capabilities evolve.

5. Results

This section presents findings from two stages of testing: a pilot test with participants experienced in PD and a focus group with architects from C.F. Møller. The pilot provided initial feedback on the CAPE AI tool and workshop structure, informing subsequent adjustments. The focus group provided expert reflections on the potential value of CAPE AI. The findings from both stages are presented in the following sections.

5.1 Pilot Test Validating Interaction Flow and Informing CAPE AI Refinements

The pilot test findings were analysed through a qualitative, reflective process aimed at extracting design-relevant insights from participant feedback and observations.

The participants responded positively to the overall format. Participants did not feel rushed, nor did they feel that any section had too much time allocated. The individual task served as an effective icebreaker, helping them ease into the idea generation process, which was praised during the interview. Their interaction with the AI was also positive; the participants understood how to use the tool and actively participated in generating ideas throughout the workshop. Furthermore, the hybrid setup, which combines physical inspiration cards with AI-generated images, proved effective in supporting discussions and engagement. However, some participants noted a slight disconnect between the cards and the outcome from CAPE AI, which initially made it less intuitive to link their card selections directly to the generated image. This challenge was identified and subsequently addressed in the refinement of CAPE AI, as the stable diffusion model was fine-tuned.

Not all feedback could be incorporated within the project's scope. For instance, participants expressed a desire to view multiple generated outputs per round, and some found the camera button difficult to locate due to its small size and low visibility. While the latter issue was noted, resolving it would have required changes to the Gradio interface, which lay outside the technical scope of this prototype. Feedback regarding unclear instructions and participant expectations was addressed through refinements to the workshop structure and the tool's integration. These design trade-offs and limitations are discussed further in Section 4.4.

Based on this feedback, the workshop structure was refined, and CAPE AI was fine-tuned to better align the output with the inspiration cards.

5.2 Focus Group Evaluation of CAPE AI's Impact on Engagement, Participation, and Future Use

This section presents findings from a thematic analysis of the focus group conducted with architects from C.F. Møller, based on the audio transcription and observational notes. The analysis explores how CAPE AI influenced group dynamics, facilitated idea generation, and prompted reflections on levels of participation and potential future use cases.

Themes were identified using a hybrid approach, combining deductive codes based on our research focus with inductively generated insights from the transcript and observation notes. The findings are organised into the following themes: Collaborating through physical and digital interaction, Creating dialogue through visualisation, Level of participation, Real-world scenario uses, and Potential use cases for other workshop types.

Fostering Collaborative Engagement Through Physical–Digital Interaction

The interaction between the Methodkit cards and the CAPE AI tool played a central role in shaping the group, as reflected in both participant feedback and our observations. Participants viewed the combination of the physical and digital as a mechanism that brought them together, facilitating collaborative engagement and collective ideation. One participant described the experience as *"activating in the way that we had to work together... that we had to share a bit around it. That it's something we do together."*, suggesting that physically holding the cards and using a shared screen fostered mutual focus. Rather than working individually, participants actively coordinated their actions of holding cards, positioning them for the camera, and discussing the images out loud. One participant noted, *"It was pretty cool with the cards, they had to be held up. That way you can't just go off on your own."*, reinforcing the collaborative nature of the task. Having physical cards to work with kept the participants grounded in a shared activity, preventing the interaction from becoming an isolated, screen-based task. One architect remarked, *"You stick to the idea that you're actually trying to do it together, so you don't end up just sitting there alone with your phone or doing your own thing."*

While the digital interface enabled visualisation and ideation, the architects noted that the setup was slightly awkward, with one commenting, *"I think right now it was a bit awkward because of the computers and cameras. If it was with a phone instead, I think it would be pretty okay."* Despite this, the overall effect of the hybrid setup was viewed positively: *"Yeah, it makes the group feel more like a group."* This sentiment was mirrored in our observations, where participants collaborated on the technical aspects of the task, engaged in idea discussions, and exhibited visible joint decision making. These interactions demonstrate how the hybrid setup facilitated a sense of cohesion and enabled collaborative ideation.

Visual Ambiguity Encouraged Shared Reflection and Collective Ideation

The visual output generated by CAPE AI played a key role in supporting dialogue within the group. Rather than presenting a final solution, the images served as visualisations of key concepts, helping participants reflect, share perspectives, challenge assumptions, and build on one another's ideas. As one architect explained, *"It's not about a precise solution, it's about gathering all the ideas and stories and starting a shared narrative around it."*

Throughout the workshop, the visuals often prompted spontaneous reactions, participants laughed, expressed surprise, "wow," "ohhh," "uhhh", and began discussing what they had expected to see based on the cards they selected *"Wait... is that a petrol station? I mean, it's not exactly what I expected based on the cards, but it kind of looks like one."* These moments revealed underlying assumptions and opened up conversations about how closely the AI-generated images aligned with their intentions. In many cases, the unexpected outcomes led to reflection, as participants considered what worked well, what felt off, and how the images could be interpreted or improved, *"Okay, so… is this a flower field or did someone plant corn outside the market? Either way, it's kind of funny, it makes me think we could mix edible plants with something more decorative."* One architect remarked, *"The image changes and gives different options, that you can build on those stories,"* suggesting that the variability encouraged creative thinking and kept the conversation open rather than converging too early on fixed solutions. This dynamic supported the development of shared understanding, with the visuals serving as flexible reference points for co-developing ideas. Storytelling emerged as a central mode of engagement, as participants used the images to construct shared narratives and explore possibilities collaboratively.

For architects trained to think spatially, the generative images were not necessarily needed to unlock ideas. However, they recognised the value of such visuals in workshops with non-experts. *"I think it's really good for idea generation, because again, maybe for me, it's hard to switch off the architect brain, but I can totally imagine that for people who don't have those thoughts and don't think visually, it's a really good starting point,"* one participant reflected. This sentiment points to the tool's potential in levelling the communicative playing field between experts and citizens, by offering a shared visual language through which to explore ideas. There were also practical suggestions for enhancing the tool's impact on dialogue, particularly through improved interface design. One architect proposed that *"It would actually be nice if, once it was fully generated, the image popped up and filled the whole screen?"*, a change that might further support collective attention and strengthen the role of the image in guiding group discussion. Together, these reflections indicate that CAPE AI did more than generate images; it supported the creation of a shared space for visual dialogue. The tool allowed participants to explore, interpret, address assumptions, and co-construct ideas, laying the groundwork for collaborative ideation processes that could include both experts and citizens.

CAPE AI Enabling Participation Beyond Token Input

Architects shared their views on the extent of citizen participation that CAPE AI could enable in future workshops. Their reflections focused on the tool's potential to facilitate collaborative engagement rather than simply collecting input. One participant remarked, *"Co-creation, yes, it might be usable in that context."*, suggesting that the tool could support active involvement from citizens in shaping ideas. Another stated, *"I'm also thinking dialogue and co-creation. It would be at those stages that it would be relevant."*, positioning the tool within phases of participatory processes where mutual exchange and creative exploration are central.

To better understand what kind of citizen involvement the architects are pointing towards, these reflections can be considered in relation to Arnstein's Ladder of Citizen Participation, which ranges from nonparticipation to complete citizen control [1]. The architect's comments suggest that CAPE AI could support forms of participation aligned with the middle to upper rungs of the ladder, particularly the stages of 'partnership' and 'placation', depending on how the tool is framed and used. CAPE AI's ability to facilitate dialogue and support idea generation may contribute to more inclusive processes, provided that input is meaningfully integrated.

Relevant for Real World Use

Architects appreciated the CAPE AI workshop structure and its potential. While the current interface was seen as straightforward and easy to use, they emphasised the need for a facilitator interface that would make it easy to set up and manage the tool in a real workshop context.

In addition to usability, some architects pointed to the value of accessing workshop data to support evaluation and reflection. One architect remarked, *"But something I'd really like to be able to get out of this is all the data behind it. Like, what words were emphasised, and how many people chose which cards — so you also have something quantitative to measure against."* Another architect reflected on how participants might benefit from more expressive input options, particularly for conveying mood or atmosphere, which they often emphasise in their workshops. They suggested, *"You could also combine it with some image cards that people could choose from if they wanted to express certain moods, and in that way, maybe guide people more, beyond just using the word cards."* Other participants added that being able to iterate on a generated image, rather than starting from scratch each time, could give participants more creative freedom.

Architects Saw Broader Workshop Potential Beyond Urban Planning

The architects were not only positive about CAPE AI's use in urban planning workshops but also saw potential for other settings, noting, *"It could also be used in conversations about the desired atmosphere within a building."* Another architect suggested it could offer a new way to engage teenagers *"I could imagine using it in a workshop with teenagers, they use words differently, so turning their ideas into images might help us actually get what they're trying to say."* These reflections suggest that the tool may be applicable beyond early-stage urban planning, supporting a wider range of dialogue-driven design processes.

6. Discussion and Future Work

This study aimed to investigate how generative AI-supported visualisation can foster shared understanding and citizen participation in urban planning workshops. While previous work has shown AI's potential in design ideation, it often focuses on polished or finalised design outcomes [11, 15, 27]. The role of tangible artefacts in PD is well established, but their integration with generative AI remains underexplored. To address this, we developed CAPE AI, a tool that links physical inspiration cards with real-time image generation, and tested it with experts to examine its potential to support communication and idea generation. Rather than replacing human creativity, the AI is positioned as a tool that encourages exploration and dialogue through visualisation.

6.1 Facilitating Shared Interpretation through Tangible Interaction and AI Visuals

Our testing suggests that CAPE AI has the potential to support collaborative ideation by combining tactile and digital elements into a participatory workshop. Participants highlighted how physical interaction with MethodKit cards helped structure discussions, foster collective storytelling, and create a group dynamic, while the AI visuals prompted reflection, shared interpretation, and the building of a joint narrative. This aligns with Hansen and Dalsgaard's [13] paper on the productive role of physical artefacts in participatory events, where tangible materials enhance accessibility for non-experts. While previous work has focused on tangible artefacts or digital tools to support PD [9, 13, 20, 21], the CAPE AI workshop utilises both to create immediate visual feedback on participants' ideas, supporting an iterative and responsive design process.

In comparison to studies such as Guridi et al. and Joshi et al. [11, 15], which demonstrate how generative AI can reduce assumptions, CAPE AI highlights how visual outputs can help articulate preferences without necessarily aligning with their assumptions. We observed in our workshop that the generated images were not always accurate to the prompt, but they facilitated co-reflection and helped surface participants' assumptions. The observation demonstrates that the value of generative AI extends beyond accuracy to its potential to foster meaningful dialogue, which was supported by the architects' feedback. While CAPE AI differs from Guridi et al. and Joshi et al. in its assumptions, they all focus on creating faster iterations and fostering shared language in PD settings. Furthermore, Wang et al. [27] also focused on faster iterations in the idea generation phase in the context of existing layouts. Similar to RoomDreaming, CAPE AI aimed to situate ideas within a specific spatial setting; however, the two tools used different

techniques to achieve it. CAPE AI's purpose was to encourage open-ended exploration rather than deliver precise outcomes. Unlike RoomDreaming, the tool maintained ambiguity to prompt broader discussion at the early stages of exploration.

In summary, while earlier studies have shown that generative AI can support the later, more polished stages of design [11, 8, 27], our study demonstrates that it can also play a valuable role in the early, explorative phases by fostering creative engagement and dialogue in participatory settings. This positions the role of AI, not as a replacement for facilitation, but as a visual aid that contributes to shared understanding.

6.2 Citizen Influence Depends on How Tools Are Embedded in Decision-Making

While the architects in the focus group suggested that CAPE AI could support higher levels of citizen participation, it is important to recognise that the tool itself does not determine the level of power citizens hold. This is ultimately shaped by how facilitators frame the process and how participant input is incorporated into decision-making. Such a perspective reflects Arnstein's [1] argument that meaningful participation depends not only on engagement, but on the actual redistribution of power.

This distinction is echoed in research by Maquil et al. and Korsgaard et al. [21, 9], who emphasise that while interactive tools can support expression and visualisation, they do not guarantee empowerment and meaningful influence unless participation is structurally embedded into the decision-making process. These insights informed our approach, in which the workshop structure was designed to support facilitators in clarifying the scope of citizen influence.

CAPE AI's potential to support empowerment depends not only on its ability to foster dialogue and idea generation, but also on how it is embedded within a participatory process that actively recognises and incorporates citizen input. This aligns with Arnstein's argument that genuine participation must go beyond tokenism to ensure that citizens have real influence over outcomes [1]. Similarly, a recent review of participatory methods in urban development highlights that the way participatory tools and workshops are structured significantly affects the quality and depth of citizen involvement [10]. Without this scaffolding, the participatory potential of even the most advanced tools remains limited.

6.3 Addressing Technical Limitations and Expectation Mismatches

Despite the promising results, our testing surfaced areas for improvement. A key issue was the mismatch between participants' expectations and the AI-generated outputs. As noted by Joshi et al. [15], everyday language can produce ambiguity or overly dominant visual elements. In our case, the fixed pairing between MethodKit cards and prompts limited participants' control over the results. This sometimes made it difficult to see a clear link between their intentions and the output. However, as previously mentioned, even when the visuals were misaligned with expectations, they still served as entry points for reflection and conversation.

Another challenge was the trade-off between technical stability and interactivity, where CAPE AI lacked the features to refine images iteratively. As a result, the tool was less responsive to the evolving nature of the group discussions, limiting its support for dynamic ideation. Participants expressed a clear wish to modify or build upon existing outputs; this functionality would be interesting to explore in a future development. However, since the prototype was only tested with architects and not the intended target group of citizens, it remains unclear whether this level of modification would be expected or missed in practice.

6.4 Future work

This section outlines future directions for research and development. It includes considerations for adapting the tool to other design contexts, the importance of involving non-expert participants in future evaluations, and opportunities to refine the tool's technical features and data capabilities based on expert feedback.

CAPE AI May Support Visual Dialogue in Human-Computer Interaction Contexts

Although the architects identified a potential for using CAPE AI in other areas of architectural practice, there may also be value in adapting it and aspects of its workshop structure to other design-related fields. This would require adjustments to both the prompt formulation and the MethodKit cards to suit new domain contexts. In addition, such

adaptations would need to be tested with relevant user groups to evaluate the tool's ability to support dialogue through visualisation in the given field. As Human-Computer Interaction researchers, we see potential for applying CAPE AI in ideation workshops, where inspiration cards are known to support creativity, discussion, and diverse design perspectives [4].

Towards Inclusive Evaluation and Practical Deployment of CAPE AI

Due to the lack of ongoing urban planning citizen workshops at C.F. Møller during the research period, only expert participants were involved in the current study. Engaging architects and PD experts was considered appropriate in this context, as they were able to provide detailed, domain-specific feedback on both CAPE AI and the workshop structure. Their insights helped identify strengths, limitations, and practical considerations for future implementation. However, future research should involve real-life urban planning workshops that include citizen participants. Testing with non-experts is essential to ensure that tools are understandable, accessible, and engaging. For example, Wilson and Tewdwr-Jones [29] describe how digital visualisation tools must be tailored to the communicative needs of citizens in urban planning contexts, emphasising the importance of clarity and inclusivity. Similarly, Mahyar et. al [20] highlight that involving non-expert participants not only expands the inclusiveness of participatory processes but also surfaces new kinds of feedback that expert users may overlook. Testing CAPE AI with citizens would therefore offer valuable insights into how non-experts interact with the tool and whether it meaningfully supports dialogue and idea development, particularly through the use of visualisations.

Such real-world testing could also be extended to include a more advanced prototype. For example, a future version of CAPE AI might incorporate a dedicated interface that enables architects to configure and use the tool during workshops. Although this interface was not developed within the scope of the current project, it was highlighted by the architects as a necessary feature for practical implementation. Furthermore, this interface could store data about the cards used in each generation, enabling the collection of quantitative data, a feature that the architects expressed interest in during the focus group interview.

In summary, this study explored how generative AI can support participation in an urban planning workshop by fostering dialogue and shared understanding. CAPE AI combined physical cards and AI imagery to enable collaborative ideation, but its effectiveness ultimately depends on how it is implemented. While expert feedback was promising, real-world testing with citizens is essential to assess whether the tool effectively supports inclusive and meaningful participation.

7. Conclusion

This study aimed to investigate how generative AI-supported visualisation can facilitate meaningful citizen participation in early-stage urban planning workshops, going beyond what Arnstein outlined as nonparticipation and the lower levels of tokenism in her typology of citizen participation [1]. We addressed this by developing and testing CAPE AI. This participatory tool integrates physical cards and real-time AI image generation within a co-creative workshop structure to create a shared understanding between participants and architects.

Our contributions are threefold:

1) The development of CAPE AI, a prototype that integrates AI-generated imagery into a participatory workshop format, enabling participants to engage with visual content derived from physical inspiration cards.
2) A co-creative workshop structure that combines physical and digital materials to scaffold participation in early-stage urban planning.
3) An expert-based evaluation offering insights into how generative AI may support inclusive dialogue and citizen participation in design processes.

These contributions extend current research by positioning AI not as a solution provider, but as a mediator of dialogue and imagination in the early stages of idea exploration, especially valuable in contexts where design expertise varies widely. Through a focus group with architects, we found that AI-generated visuals, paired with tangible interaction, can prompt collaborative reflection and support shared understanding among participants. The use of visual prompts can help make abstract ideas more tangible and bridge differences in design literacy. While the tool itself does not determine the

level of participation, its ability to foster dialogue and interpretation suggests potential for supporting more meaningful forms of citizen involvement, in line with the higher rungs of Arnstein's participation ladder.

Further research is needed to understand how citizens interact with tools such as CAPE AI in practice and whether the intended inclusivity is effectively translated into real-world settings. However, this work offers a hopeful step toward participatory design practices that are not only more engaging but also more inclusive, where visual tools help make abstract ideas tangible and bring a broader range of voices meaningfully into the design of urban futures.

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Appendix A
Workshop Phases

Phase 1

The workshop begins with a short introduction to the CAPE AI format. Participants are welcomed and introduced to the overall purpose of the session: to collaboratively explore and express ideas for urban spaces using physical cards and AI-generated imagery. The facilitators present the reference photo of the specific space they will work on, explain the tools involved, including the MethodKit cards and the CAPE AI interface, and set expectations for participation level, collaboration, and creativity throughout the session.

Phase 2

The second phase was structured with the inspiration from C.F. Møllers workshop. The Methodkit cards serve as the starting point of the workshop, where each participant is given four cards individually, using them as a prompt for personal reflection on the topics or themes that matter most to them. This individual exercise is followed by a group discussion in which participants share their chosen cards and the reasoning behind their selection. After the discussion, the participants have time to explore the remaining cards that were not a part of the initial selection. This allows them to reconsider and re-prioritise their topics of interest, and finally present them to the group. By the end of this phase, each participant should have selected up to four cards that they will use for idea generation in the next part of the workshop.

Phase 3

In the next phase of the workshop, participants are introduced to CAPE AI through a set of example visualisations, which help clarify the tool's capabilities and align expectations before they begin using it. The goal is for them to collaborate with the tool to create visual representations of their ideas, using the cards they selected in the previous phase. Using up to five cards collectively, they craft a prompt that guides the AI in generating an image based on their shared vision. The cards are held in front of the camera, which captures a photo that is uploaded directly through the Colab interface. Once uploaded, CAPE AI uses optical character recognition (OCR) to detect and interpret the text on the cards, which is then mapped to corresponding image generation prompts in a local database. The AI processes this input to create visual representations that reflect the selected themes. The resulting image is displayed in real time on a shared screen or projector, making it visible to all participants. The process time can vary from 20 to 40 seconds; during this time, the group is expected to talk about their expectations of the image. This setup encourages immediate group reflection and discussion. In the final phase of the workshop, each group presents their final generated image and the ideas behind it to the rest of the participants. This creates an opportunity for dialogue, reflection, and inspiration between groups, strengthening the collaborative and participatory nature of the process.

Phase 4

In the final phase, the groups present their selected image and reflect on their ideas in plenary. It is their opportunity to describe their wishes and thoughts behind their chosen cards, as well as their interpretation of the image. Simultaneously, they gain insight into the reflections of other groups and can compare their ideas.